Programmer's Introduction

WANG

Programmer's Introduction

5th Edition, April, 1981
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800-1101PI-05

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This manual replaces the fourth edition of the *VS Programmer's Introduction* (800-1101PI-04). For a list of changes made to this manual since the previous edition, see the "Summary of Changes".

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PREFACE

This manual introduces the programmer to Wang Laboratories' VS system. It is written for anyone who is at least a junior-level programmer familiar with basic data processing concepts.

After reading this manual and the VS Program Development Tools manual, you will be able to work with the VS menus and with the Command Processor and to create, compile and run a program on the VS.

This manual is organized as follows:

Chapter 1 introduces the VS and explains basic concepts you must understand to use the system

Chapter 2 describes the VS workstation, and explains how to use the different keys

Chapter 3 describes the Command Processor (your main means of communication with the system) and contains all the information you need to use it

Appendix A contains the VS workstation character set

Appendix B describes three kinds of decimal representation commonly used by the VS

Appendix C describes the VS naming connections

All new programmers using the VS should read this manual for a general introduction to the system. For detailed information about VS system features and programming languages, consult the following manuals:

VS/IIS Operator's Guide	800-1109WO
VS/IIIS Supervisor's Procedures	800-1110WS
VS Operating System Services	800-1107OS
VS Principles of Operation	800-1100PO
VS Program Development Tools	800-1307PT
VS System Management Guide	800-1104SM
VS System Operation Guide	800-1102SO
VS Utilities Reference	800-1303UT
VS Assembler Reference	800-1200AS
VS BASIC Reference	800-1202BA
VS COBOL Reference	800-1201CB
VS Procedure Language Reference	800-1205PR
VS RPGII Reference	800-1203RP

SUMMARY OF CHANGES

FOR THE 5TH EDITION OF THE VS PROGRAMMER'S INTRODUCTION

TOPIC	DESCRIPTION	PAGES
Spooling	Now includes spooling to remote devices.	1-15
Command Processor	The Command Processor menus have been slightly changed to account for the following commands:	3-1
ENTER WORD PROCESSING	This Main menu option lets you enter Word Processing mode directly from the Command Processor, if you have the Word Processing software package and a combined workstation.	3-39
MOUNT/DISMOUNT VOLUMES	This option was previously a Command Processor menu command. It is now available through the MANAGE DEVICES command associated with PF6 on the Command Processor menu.	3-29, 3-34
SHOW DEVICE STATUS	This option was previously a Command Processor menu command. It is now available through the MANAGE DEVICES command associated with PF6 on the Command Processor menu.	3-26, 3-28, 3-33
CONTROL PRINT/ JOB QUEUES	This Command Processor option was previously available through PF11. It is now available through PF4 - MANAGE PRINT/PROCEDURE QUEUES.	3-15
DEVICE MANAGEMENT	The new MANAGE DEVICES command, associated with PF6 on the Command Processor menu, allows you to view status information about all the peripheral devices on the system and to mount, dismount, and perform other device management functions.	3-15
Editor Linker Debug facility EZ languages GETPARMs Return Codes	Now documented in VS Program Development Tools (800-1307PT).	

This manual is updated by:
Addendum 800-1101PI-05.01

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CHAPTER 1
INTRODUCTORY CONCEPTS

1.1 SYSTEM OVERVIEW

The Wang VS offers an integrated programming environment which is convenient and easy-to-use, with software facilities deliberately tailored to accommodate both the technical and nontechnical user. The system offers interactive and noninteractive background processing, large on-line storage capabilities, a variety of languages, and support for multiple users and multiple concurrent job executions. The primary features of the VS are listed below:

- Interactive Processing

  Users can communicate with the system in a direct, conversational manner through their workstations. The system communicates with the user by displaying prompts at the workstation screen and the user responds, queries, and controls the system by entering information at the keyboard. Program results and system responses can be displayed and reviewed immediately, thus eliminating the traditional wait and delay for printed copy. The system's facilities are easily accessed and used, aiding in all phases of program development, from source code entry to debugging, testing, and execution. Consult the VS Operating System Services or the VS COBOL Reference for further information.

- Noninteractive Background Processing

  As an alternative to interactive system communication, users can submit jobs for noninteractive processing, thus freeing both the user and the workstation. Once a job is submitted, no further user response is necessary. Submitted jobs are listed in the procedure queue, from which they are controlled and processed. For further information, see the VS System Operation Guide.

- Virtual Memory

  The VS offers a technique of memory management known as virtual memory, which utilizes disk storage as an extension of physical memory. The operating system ensures that only those sections of a program and its associated data used during program execution are kept in main memory, while the remaining unreferenced sections are kept on a disk until needed. This technique provides each user with a virtual memory of one million bytes, effectively eliminating the need to modularize or overlay programs. Consult the VS Operating System Services for further information.

- Multiple Users, Multiple Jobs

  The VS supports multiple workstations, all of which can run jobs concurrently. The system places no restrictions on the types of jobs which may be run simultaneously from the various workstations. Consult the VS Operating System Services or the VS COBOL Reference for further information.

- Storage Capacity and Physical Memory

  To accommodate varied storage and usage requirements, the VS provides storage capacity of up to 2.3 billion bytes (up to 4.6 for the VS-100) and physical memory of up to 512K bytes (up to 2048K for the VS-100). For further information, see the VS Operating System Services.

- Automatic Program Sharing

  When two or more users run the same program at the same time, they automatically share the same copy of the program's logic section in memory. This technique eliminates unnecessary duplication and increases total system performance. See the VS Operating System Services for further information.

- Automatic File Sharing

  To enable several users to perform update and/or inquiry operations on a common file concurrently, the VS provides an integrated shared file capability. In data entry applications, for example, all users can directly update a single master data file simultaneously. The additional steps of creating separate, temporary files for all users, then merging them together, are thereby eliminated.

- Buffering Techniques

  The VS utilizes a technique called anticipatory buffer priming, in which data is read into a buffer before it is needed for processing. In this manner, the I/O wait for data is reduced. Additionally, the VS uses a large buffering technique for sequential access. This technique enables many records to be loaded from storage into main memory in one operation, reducing the total number of I/O operations and thus making the system more efficient. Buffer pooling, used for random access efficiency, reduces device I/O by retaining the most recently used data in memory, making it more quickly accessible. Consult the VS Operating System Services for further information.

- Multiple Languages

  To facilitate programming flexibility, three high-level, compiled languages are supported on the VS: BASIC, COBOL, and RPG II. Also supported are an Assembler language and a system command language called Procedure language. VS COBOL and RPG II offer versatile

file-handling and output-formatting capabilities which make them particularly beneficial for business and commercial data processing applications. VS BASIC is an easy-to-use, general-purpose language which offers both a wide variety of built-in numeric functions and powerful character string manipulation capabilities. VS Assembler is a machine-level language providing maximum efficiency and flexibility in the use of the operating system services. The Procedure language is especially useful for limited interaction and noninteractive processing on the VS. For further information on these languages, consult the languages' respective manuals.

- Automatic Print Spooling

  To improve I/O time, as well as to make more efficient use of workstations and printers, the system provides automatic print spooling. Print spooling is a technique in which printer output is temporarily stored on disk rather than immediately printed. The names of all spooled print files are entered into a print queue and are subsequently printed when a printer becomes available. Print spooling offers the dual benefit of freeing the individual workstation or background program from operating at printer speed and enabling the printers to be scheduled most efficiently to handle the total system requirements. With automatic print spooling, program execution is never held up because a needed printer is busy. Consult Section 1.10, "File Security," for further information.

- Versatile Security System

  A multilevel security system, providing security on both the system level and the individual file level, permits protection of the entire system and of individual files from unauthorized users. See the VS System Management Guide for further information.

- Programming Environment

  An integrated programming environment is available through the VS system utility programs. These utilities include an interactive text editor for entering, editing, translating, and running programs; a symbolic debug processor for easy identification and correction of program errors; a versatile data entry, file maintenance, and report generation facility; and an assortment of system utility programs, including sort, copy, and link routines. Many of these programming facilities, including the text editor, debug facility, and link utility, are documented in the VS Program Development Tools manual.

1.2 PROGRAMMING INTRODUCTION

The VS is designed to be an easy-to-use system which is essentially self-documenting. In most cases, all the information required by the user to perform a particular task is specifically requested by the system program which performs that task in the form of prompts on the workstation screen. There are, however, a number of important basic concepts which must be understood before effective use can be made of the system. These concepts include the following:

- Workstations, system users, and the LOGON procedure.
- System access via the Command Processor.
- Program interruption and the HELP key.
- The file management hierarchy (files, libraries, and volumes).
- Default parameter specification and the system program library.
- File security.
- Noninteractive background processing.

These fundamental concepts are introduced and developed in the sections that follow in this chapter.

1.3 WORKSTATIONS, SYSTEM USERS, AND THE LOGON PROCEDURE

The Wang VS provides three types of workstation modes for the programming user: user mode, dual mode, and operator mode. User mode permits access to the system's Command Processor menu, through which a user can perform operations such as developing, debugging, and running programs. Operator mode provides access to facilities used for system monitoring and control by an operator, such as interactive device status and control over system devices and functions. Dual mode offers both user mode and operator mode facilities.

User mode is available only after logging onto the system and thus is restricted to system users. Operator mode, however, is directly accessible on both dual mode workstations and Operator's Consoles without logging onto the system. This manual documents only the facilities available in user mode. For more information concerning operator mode and the Operator's Console, consult the VS System Operation Guide.

Access to VS system resources is restricted to those users designated as system users and can be specifically limited through certain security features. Before obtaining access to the system, each user must be assigned a unique User ID and password by a system security administrator.

The first display encountered by a user at a workstation is the LOGON display. LOGON requires that the user enter a User ID and password, as shown in Figure 1-1. Note that the password is not displayed when it is keyed in.

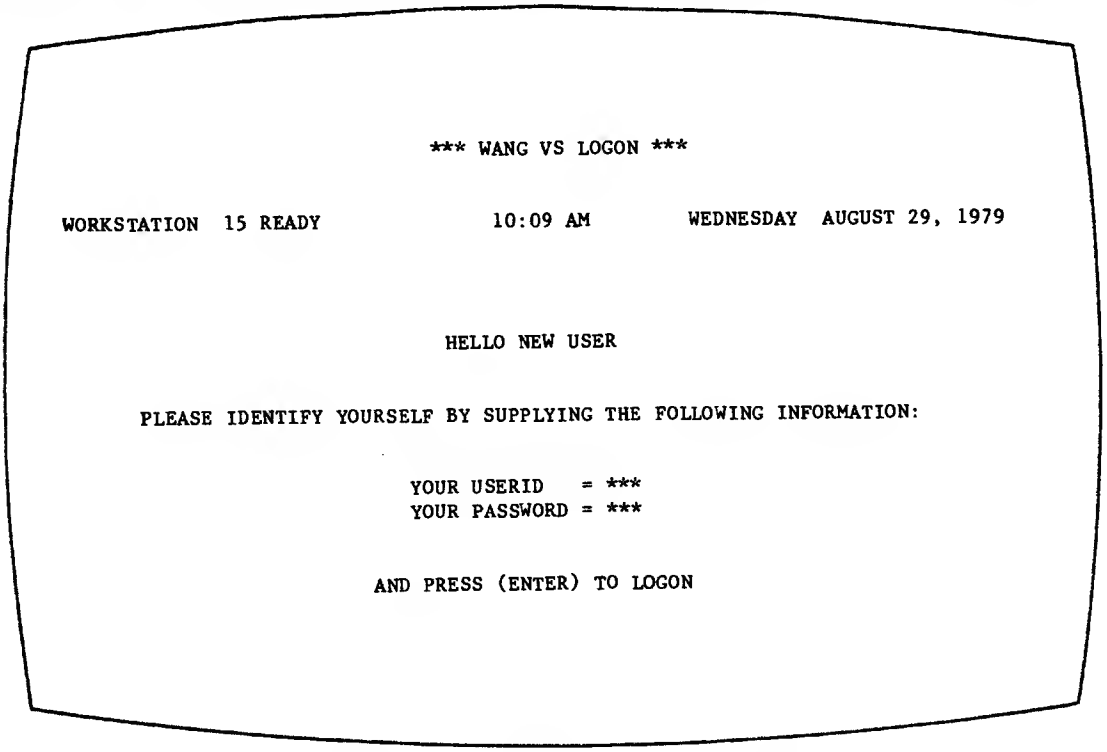


Figure 1-1. LOGON Screen Format

The entered values are then checked against the System User List, and, if they are located in the list and the user has LOGON rights for that workstation, the user is immediately logged on the system. Otherwise, LOGON returns a message indicating that an invalid User ID or password has been specified or that the user does not have system access rights from that workstation, and the LOGON prompt remains displayed.

The process of logging a new user on the system from a particular workstation involves automatically resetting all default parameters to the system defaults (in effect, wiping out any defaults set by the previous user at that workstation) and passing control to the Command Processor. (See Section 1.9, "Default Parameter Specification and the System Program Library," for an explanation of default parameters.) Following a successful log on, the Command Processor menu is displayed on the workstation screen, unless a LOGON program or procedure has been specified for the user by the system security administrator (see the next section).

1.3.1 Restricting User Access to the System

For many users, the system security administrator may specify a LOGON program or procedure that is run immediately when the user logs on the system. Through the use of LOGON programs or procedures, any user can be prevented from accessing the Command Processor, thus restricting access to the system. For more information on LOGON procedures, consult the VS Procedure Language Reference.

In addition to LOGON programs and procedures, the system security administrator can restrict any individual user to (or from) system access at specific workstations. Additionally, a user can be restricted from using the HELP Processor (see Section 1.6, "Program Interruption and the HELP Key"). For a HELP-restricted user at a nonoperator workstation, pressing the HELP key causes the workstation alarm to sound; at dual mode workstations, pressing the HELP key in user mode allows direct entrance to operator mode. All IDs, passwords, and access restrictions of all system users are recorded in the System User List, which identifies all users who have access rights to the system.

1.4 SYSTEM ACCESS VIA THE COMMAND PROCESSOR

All user communication with the VS is carried out by issuing commands which direct the operating system to perform a variety of tasks. Commands are used to perform such operations as running programs, setting default parameters, scratching and renaming files, initiating debug processing, and examining various aspects of the system status. Commands are issued interactively by the user at the workstation from the Command Processor menu or can be defined and issued from a user program. Alternatively, some commands can be written in a special type of text file called a procedure file (written in the VS Procedure language) and executed without user interaction. The command statements which can be used in procedures are discussed in the VS Procedure Language Reference.

Commands are issued interactively from the workstation by selecting from among the options displayed on the Command Processor menu, shown in Figure 1-2.

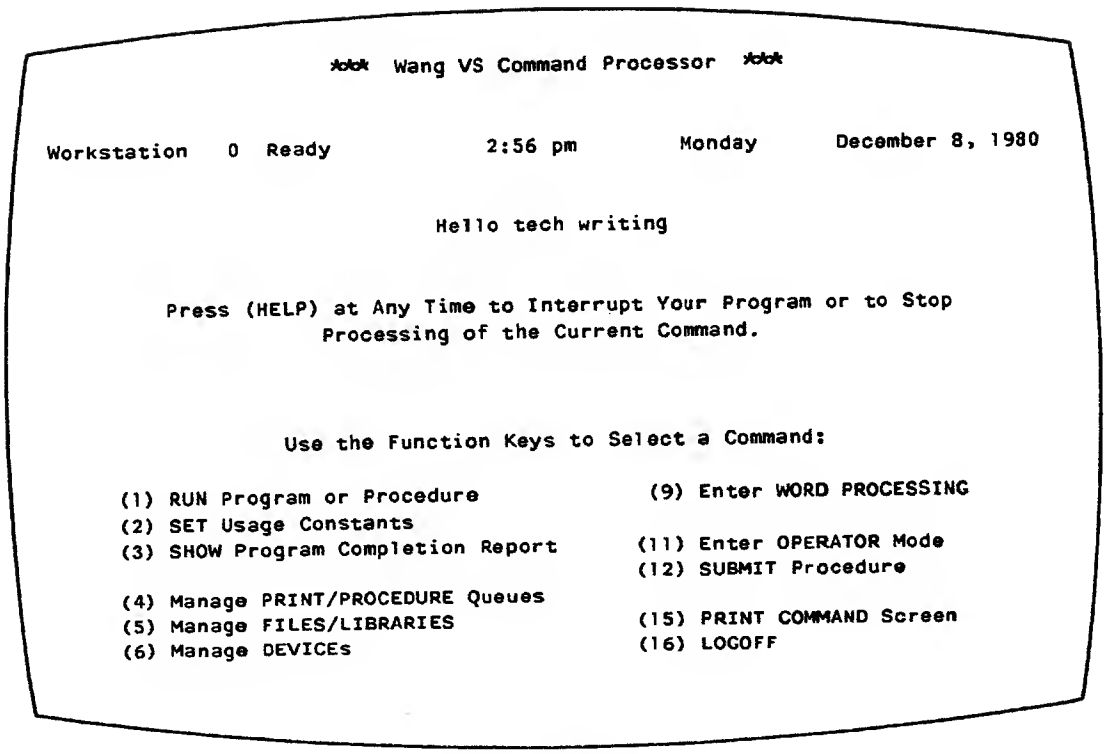


Figure 1-2. Main Command Processor Menu

This menu contains descriptions of the available system commands and associates each command with one of the Program Function (PF) keys on the workstation keyboard (see Chapter 2 for keyboard information). The user can select a command simply by pressing the appropriate PF key. The commands available on the Command Processor menu are briefly introduced below and fully discussed in Chapter 3:

PF Key	Command	Action
1	RUN PROGRAM OR PROCEDURE	Runs the specified program or procedure. (See Sections 1.5, "Running Programs Interactively from the Workstation," and 3.2, "RUN PROGRAM OR PROCEDURE.")
2	SET USAGE CONSTANTS	Permits specification of default values for common parameters: file and library locations, printer output, and noninteractive background job processing. (See Sections 1.9, "Default Parameter Specification and the System Program Library," and 3.4, "SET USAGE CONSTANTS.")
3	SHOW PROGRAM COMPLETION REPORT	Provides information on the total resource requirements of the program or procedure just completed. (See Section 3.5, "SHOW PROGRAM COMPLETION REPORT.")

PF Key	Command	Action
4	MANAGE PRINT/ PROCEDURE QUEUES	Permits control and manipulation of print and procedure queues. (See sections 1.8, "Printing Capabilities," 1.11, "Background Processing," and 3.7, "MANAGE PRINT/PROCEDURE QUEUES.")
5	MANAGE FILES/ LIBRARIES	Permits examination of the contents of volumes, libraries, and files, as well as scratching, renaming, printing, and protection of accessible libraries and files. (See Sections 1.7, "File Identification and Access on Disk and Tape Volumes," and 3.8, "MANAGE FILES/LIBRARIES.")
6	MANAGE DEVICES	Allows viewing of status information about peripheral devices and permits mounting, dismounting, and other device management functions. (See Sections 1.7, "File Identification and Access on Disk and Tape Volumes," and 3.9, "MANAGE DEVICES.")
9	ENTER WORD PROCESSING	Allows accessing word processing mode directly from the Command Processor; it is available only if you have Word Processing software on your system. (See 3.10, "ENTER WORD PROCESSING.")
11	ENTER OPERATOR MODE	Allows access of the Operator's Console if you have a dual mode workstation. (See 3.12, "ENTER OPERATOR MODE.")
12	SUBMIT PROCEDURE	Permits submittal of a procedure to be run in noninteractive background processing. (See Sections 1.11, "Background Processing," and 3.13, "SUBMIT PROCEDURE.")
15	PRINT COMMAND SCREEN	Provides a printed copy of any screen accessible from the Command Processor. (See Section 3.15, "PRINT COMMAND SCREEN.")
16	LOGOFF	Logs the user off the system. (See Section 3.16, "LOGOFF.")

The selection of a command from this menu invokes one or more prompts requesting the user to enter the parameters required by the selected command. Such prompts and parameter requests eliminate the need for the user to memorize complex syntax rules. Similarly, the user need not take great pains in ensuring that all parameters are properly specified. In general, if a parameter is inadvertently omitted or incorrectly specified, the Command Processor simply repeats the prompt with an appropriate error message, so that the correct value can be entered.

When the user issues a command or invokes a system program or utility from the Command Processor, the screen that appears may contain a menu of command (and associated PF key) options. A PF key option available through this menu is displayed only when it is viable for the current circumstances. For example, the MANAGE PRINT/PROCEDURE QUEUES command displays a list of print or procedure queue entries and a menu of command options. Two options available from that menu are FIRST and LAST, which display the first and last screen, respectively, of print or procedure queue entries. These options appear only if more than one screen of entries exists. If the queue entries fit on one screen or less, FIRST and LAST do not appear on the menu.

The Command Processor actually has two slightly different versions of its menu. The Main Command Processor menu is displayed whenever there is no program running at the workstation. This provides immediate user access to the system upon completion of any program, so that a new program or command can be initiated at once. If a running program is interrupted prior to completion with the HELP key or as the result of an error, the Command Processor displays a Modified menu (shown in Figure 1-3). The Modified Command Processor menu permits the continuation of program execution or cancellation of the program. In addition, the Modified menu allows the selection of any of the commands available in the Main menu (except the RUN PROGRAM OR PROCEDURE, ENTER WORD PROCESSING, and LOGOFF commands), including a modified PF3 option and the addition of two options, PF10 and PF14 (see Section 1.6, "Program Interruption and the HELP key").

1.5 RUNNING PROGRAMS INTERACTIVELY FROM THE WORKSTATION

The most important and commonly used command on the Command Processor menu is RUN PROGRAM OR PROCEDURE (RUN), which is used to run both system and user programs. This command is invoked by pressing PF1 from the Command Processor menu, which prompts the user to specify the name of the program to be run. For user programs, the names of the user library and volume in which the program resides must also be specified. (User libraries and volumes are explained in Section 1.7, "File Identification and Access on Disk and Tape Volumes.") The VS provides an assortment of system utility programs, any of which can be invoked with the RUN command. System programs are stored in the System Program Library. Because the System Program Library is used as a default by the RUN command, it is never necessary to specify a library or volume name when running a program contained in the System Program Library. The user need only type in the program name and key ENTER. If the program requires additional parameters or file specifications, the user is asked to enter this information via one or more prompts. (See Subsection 1.7.2, "Files and Libraries," for more information concerning the System Program Library.)

It is important to understand that, although the system can process two or more jobs concurrently from different workstations, a single workstation can perform only one interactive job at a time. (On the VS, a job is a program or series of programs submitted for execution; for example, a background job consists of the series of programs and commands specified within the submitted background procedure.) Only <u>one</u> "root" program or procedure can be run from each workstation at any time. However, a single

root program or procedure run by the user may call/link any number of subprograms and subprocedures in the course of execution. (Note the distinction between interactive and noninteractive background jobs: a workstation can process only one interactive job at a time, but more than one background job can be submitted from the same workstation. Background jobs, also, are executed one at a time and do not interfere with interactive workstation use. See Section 1.11, "Background Processing," for more information.)

A program running at a particular workstation can be interrupted with the HELP key at that workstation if the user wishes to select a command from the Modified Command Processor menu. However, the program cannot be continued while the selected command is executing, nor can a second program at the same workstation be run while the first program is interrupted. In order to run a new interactive program, the current program must be terminated either through normal completion or cancellation by the user. For this reason, the RUN command does not appear in the Modified Command Processor menu, which is displayed when a program is interrupted (in this case, RUN PROGRAM OR PROCEDURE is replaced by the CONTINUE PROCESSING command). The user has the option of continuing the current program to completion or cancelling it manually before running another program. Similarly, the user cannot log off the system until an interrupted program has completed running or is cancelled. For this reason, the LOGOFF command is replaced by the CANCEL PROCESSING command on the Modified Command Processor menu. Finally, the ENTER WORD PROCESSING command does not appear on the Modified Command Processor menu because the system cannot run the Word Processisng program while running another program. (For further information about the Command Processor Menu, consult Chapter 3, "The Command Processor.")

1.6 PROGRAM INTERRUPTION AND THE HELP KEY

There are two ways in which a running program can be interrupted: automatically by the system itself (due to error) or voluntarily by the user. These two types of interruptions are discussed below.

Automatic interruption of a program by the system occurs whenever a user program check or an unexpected program execution error occurs. In such cases, the user has the option of cancelling the program (by pressing PF16), invoking the Modified Command Processor menu (by pressing HELP), or initiating debug processing (by pressing PF1).

Voluntary interruption of a program occurs when the user presses the HELP key. When HELP is keyed at a workstation, the program running at that workstation is immediately interrupted (any current I/O operations are completed), necessary program status information is saved by the system for subsequent program resumption, and the modified version of the Command Processor menu is displayed. (Note that it is possible to disable the HELP key for specific users, thereby preventing such users from interrupting a program and gaining access to the Command Processor. Refer to Subsection

1.3.1, "Restricting User Access to the System," for further information on HELP-disable.) The Modified Command Processor menu is identical to the main menu with only a few exceptions (discussed in Section 3.1, "Introduction"); the Modified menu is illustrated in Figure 1-3.

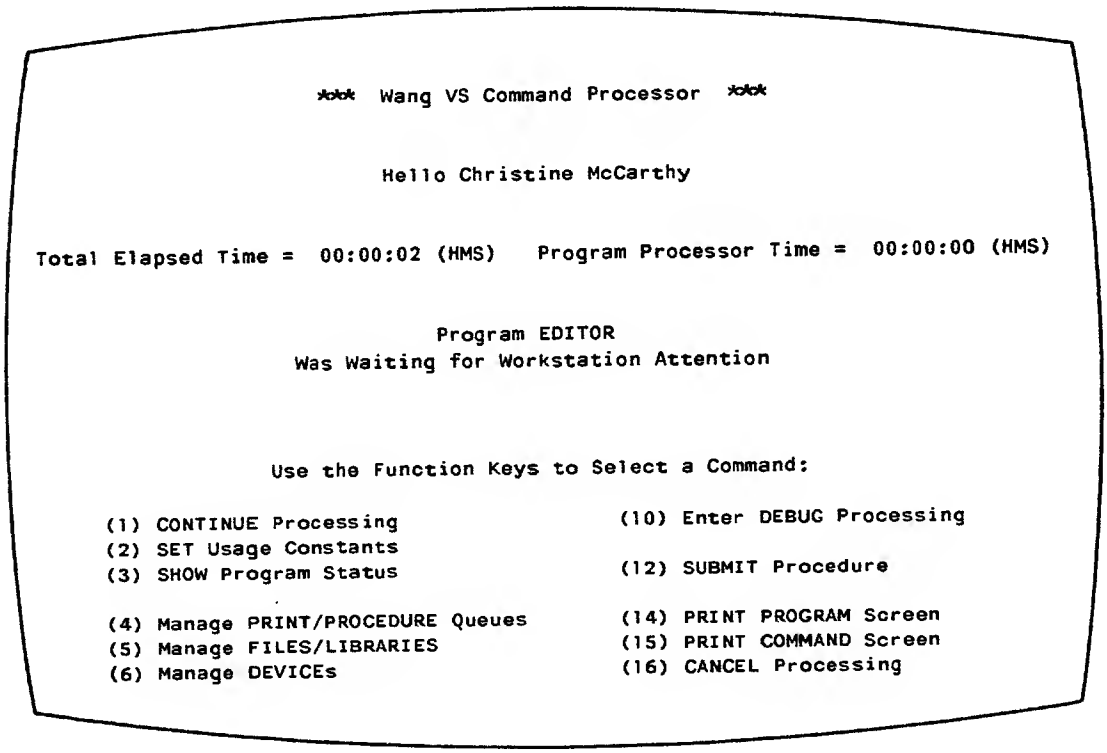


Figure 1-3. Modified Command Processor Menu

Any of the commands displayed in the Modified Command Processor menu can be invoked while the program is interrupted. The user can therefore set new default parameters, examine and/or modify the status of peripheral devices and on-line files, and, through the debug processor, examine the program itself and modify variable data values while the program is interrupted. (See Chapter 3, "The Command Processor," for explanations of these options.) When the desired functions have been completed, program execution can be continued from the point of interruption simply by pressing PF1 (CONTINUE PROCESSING).

1.7 FILE IDENTIFICATION AND ACCESS ON DISK AND TAPE VOLUMES

The VS provides a multilevel hierarchy for identifying and storing information on external storage devices such as disks and tapes. A particular collection of related information is stored in a file, which is assigned an up to 8-character, alphanumeric name. The file is assigned to a library, which can contain many files, usually of related contents. A library, also, is assigned an up to 8-character, alphanumeric name. Finally, a library is resident on a volume, which is an independent storage device (e.g., a disk).

Volumes are identified with up to 6-character, alphanumeric names. These three hierarchical levels serve to identify individual files and provide flexibility in naming conventions. Volumes, libraries, and files are described below.

1.7.1 Volumes

The VS supports disk drives and magnetic tape drives as external storage devices. Each such device holds one or more volumes. A volume is an independent physical storage medium, such as a diskette, disk pack, or reel of magnetic tape. Volumes may be permanently fixed in the drive unit (such as the fixed platter(s) in a fixed/removable disk drive) or they may be removable from the drive unit and subsequently remounted (such as a reel of tape or a diskette).

Whether it is fixed or removable, every volume used by the system is assigned a volume name unique on that system for that device type; that is, no two mounted volumes on the same VS system can have the same volume name. (However, not all volumes of the same device type, such as tape volumes, contain tables of contents on which to store their assigned volume names.) The volume name is assigned during an initialization process and remains with the volume unless explicitly changed by the user (volume names are assigned and changed via the DISKINIT or TAPEINIT utilities; see the VS Utilities Reference). Whenever a volume is mounted in a drive unit, the name of that volume is associated with the address of the drive unit. Thus, a volume mounted in any drive unit can be accessed by its volume name, without reference to the address or physical characteristics of the drive unit itself. The volume name provides a device-independent means of identifying and accessing volumes on the system, freeing the user from any concern for a volume's physical location.

1.7.2 Files and Libraries

Information stored on a disk or tape volume must be placed in a file. A file is a logical unit consisting of zero or more records. Certain commonly used files are referenced by their type of content; for example, a file containing source program text is known as a source file, or one containing printer text is known as a print file.

Every file on a disk volume is a member of a library. A library is a logical structure which permits several files to be grouped together for the purpose of identification and access. Several files which are related in some way (for example, all program files, all source files, or all files belonging to a particular user) can be assigned to the same library. The VS places no restrictions on which files may be assigned to a particular library; the conventions governing library usage are completely determined at each individual installation, based on its particular needs and standards.

No specific maintenance procedures are required of the user to create or delete a library. A library is automatically created when the first file is assigned to it and automatically deleted when the last file assigned to it is scratched. A single library (or a single file) cannot exceed volume boundary limitations, though separate libraries with the same name can be created on separate volumes (since the volume names, used for identification, are distinct).

The use of library names provides an additional level of qualification for file identification, permitting the use of duplicate file names on the same volume using different library names. This facility enables the user to give related files the same name; the files are identified by the libraries in which they reside. For example, the user could give a program file and its corresponding source file the same name and place them in two separate libraries containing object and source files. The user would then identify the files by both their file and library names. The following examples illustrate the flexibility of naming conventions in the file identification hierarchy for a hypothetical system:

Volume	Library	File
VOL001	SFKSRCE	TESTPROG
VOL001	SFKOBJ	TESTPROG
VOL001	SFKOBJ	SAMPLE
VOL005	SFKOBJ	SAMPLE

In general, whenever a file is opened, it is necessary to specify the name of the file itself, the name of the library to which the file is assigned, and the name of the volume on which the library resides. This holds equally true for program files, which must be identified for the RUN command when a program is run. An exception exists, however, in the case of system programs (which include all system utilities and compilers). (For further information on the running of system programs, consult Subsection 1.9.2, "The System Program Library.")

The job of creating and maintaining files and libraries on disk and tape volumes is performed by the Data Management System (DMS), an integral component of the VS Operating System. DMS handles all the complex "housekeeping" tasks associated with file maintenance and space allocation on external storage devices. Because DMS performs all physical I/O operations to the external devices and controls the physical location of information on each volume, users need only be concerned with the logical organization of information in a manner most suitable to their particular applications.

There are two specific types of files created on the VS which can have default volumes specified via the SET USAGE CONSTANTS command: print files and work files. Print files are disk files that contain the output sent to a printer by a program and are usually stored (i.e., by default unless otherwise specified) in the user's print library (with the exception of on-line print files; see Section 1.8, "Printing Capabilities"). Work files, discussed below, are temporary disk files used by the system during program editing, compilation, and execution.

Work Files

Work files are temporary files used by programs for internal processing only, and are created, named, and deleted after use by the operating system. Work files are stored in each user's work library(s) and their existence is generally transparent to the user. There are two possible work libraries for each user: one for interactive processing and one for noninteractive background processing. The work library names are supplied by the system and are discussed in Appendix C, "VS Naming Conventions."

If a work volume is specified by the user in the SET USAGE CONSTANTS command (PF2 from the Command Processor Menu), a work library is created on that volume; otherwise, a work library is created on a volume selected by the system.

1.7.3 Disk Volumes

A standard disk volume contains, in addition to the files stored on it, a label and a Volume Table of Contents (VTOC). The label holds the volume name, while the VTOC contains a listing of the names, locations, and attributes of all files on the volume and the libraries to which the files are assigned. When a specified file must be located, the system (DMS) will search the VTOC for the appropriate library rather than the entire volume.

A disk volume is divided into a number of physical records called blocks, each 2048 (2K) bytes in length. When a file is created, DMS automatically allocates enough space for the file by reserving a number of contiguous blocks on the disk volume. A group of contiguous blocks allocated for use by a particular file is referred to as an extent. A group of contiguous blocks which is not allocated to any file is called a free extent. If a disk volume contains only one file, that volume has two extents: one extent consisting of all blocks allocated to the file and one free extent consisting of all remaining (unused) blocks on the volume.

If a file outgrows its initially allocated space, DMS will automatically locate additional space on the volume and allocate it to the file. (DMS can allocate a total of 13 extents to any one file: up to three extents can be allocated at file creation and up to 10 in secondary allocations. If file creation requires more than three extents or the total of 13 extents is to be exceeded, the system response VOLUME FULL is elicited.) If the only available free extent is too large for the file's needs, DMS splits the extent into two, allocating one extent to the file and leaving the other free. If there are a number of contiguous free extents too small for the file, DMS combines them into a single large extent and allocates this extent to the file.

By thus splitting or grouping free extents as necessary, DMS makes the most efficient use of available disk space. Conversely, if a file is scratched, DMS automatically deallocates all extents used by the file, combines contiguous free extents, and marks the free extents as available to other files. The process of allocating and deallocating extents on a disk volume is handled completely by DMS and is transparent to the user.

In general, therefore, the user need not be concerned with the problem of obtaining additional space for expansion of a file, unless the volume itself is full or the file outgrows its initial extent by a very large margin. In some cases, a file which is expanded significantly beyond its initially estimated size may exceed its maximum allowed total of 13 extents before it runs out of disk space. One way to avoid the problem of running out of extents for a file is to follow a regular schedule of backing up and restoring volumes with the Backup utility. (Backup automatically consolidates all extents used by a file into a maximum of three extents. See the VS System Management Guide for further discussion of Backup.)

Information on the number and sizes of extents used by each file and the number and sizes of the 20 largest free extents available on a volume is stored in the VTOC. This information may be displayed at the workstation with the MANAGE FILES/LIBRARIES command. (See Section 3.8, "MANAGE FILES/LIBRARIES," for a discussion of this command. For further information on disk volume structure, consult the VS Operating System Services.)

1.7.4 Tape Volumes

Tape drives, unlike disk drives, support only sequential file organization. Tape volumes may contain a tape label (which has, among other things, the volume name) and header/trailer markers for each file, but no VTOC. (The VS supports IBM-labeled, ANSI-labeled, and nonlabeled tapes.) Thus, files stored on a tape must be written and accessed sequentially and are separated by tape marks. Each additional file written to a tape is added after the last tape mark.

The VS provides two techniques for identifying tape files: the use of file and library names and the use of a file sequence number. If a file name is specified to access a file, the tape must be searched sequentially to locate the named file. A file sequence number specifies the ordinal position of the file on the tape volume. (For example, the file sequence number of the first file on the tape is 1; of the second, 2; and of the fifth, 5.) Files are thus located by the order in which they were written to the tape. If both a file name and a sequence number are specified, the name of the file at that ordinal position is verified as the designated file name.

1.8 PRINTING CAPABILITIES

The VS provides versatile, easy-to-use printing capabilities which enable users to select printing techniques specifically suited to their individual requirements. These printing capabilities are available to users under both system and user program control, and include such features as optional automatic printing. There are three basic methods for the handling of print output. When output from a user or system program is destined for a printer, the output is intercepted by the Data Management System (DMS), and then is handled according to one of the following techinques:

1. The output is stored on disk temporarily, and the VS automatic print spooling system controls it for printing by a local printer or an activated remote printer.

2. The output is stored indefinitely on disk.

3. The output is sent directly to a printer.

These three techinques permit the user to obtain printed copy immediately, only when desired, or not at all if no printed copy is desired.

The VS automatic print spooling system provides the advantage of freeing both the user and workstation for interactive use while the system controls the print file. (Any print output sent to disk is stored in a print file.) All print files controlled by the spooling system are listed in a table of

files known as the print queue. The print queue is accessible to all users, and displays many characteristics of each listed print file, as well as offers certain manipulation options. Users can specify that a queued print file be printed automatically from the queue as soon as a printer is available, or that it be held in the queue until released for printing by a user.

The two other methods of handling print output also have advantages. Print files retained on disk but not controlled by the spooling system provide the user with the option of storing print material without cluttering the print queue. Similarly, direct printing never affects either the print queue or disk storage, and provides immediate hard copy to the user.

The manner in which print output is handled by the system is determined by the print mode assigned to that output when it is created. There are four print modes, corresponding to the printing techniques discussed above:

Print Mode	Action
H (Hold)	Print output is placed in a print file and assigned to a library on disk. Control of the print file is transferred to the print spooling system, which places an entry for the file on the print queue in a hold status pending user action.
S (Spool)	Print output is stored in a print file and assigned to a library on disk. Control of the print file is then transferred to the print spooling system, which places an entry for the file on the print queue. The print file is printed automatically on an appropriate printer by the system as soon as possible.
K (Keep)	Print output is stored in a print file and assigned to a library on disk. Control of the file is not passed to the print spooling system, however, and no entry is placed on the print queue. The print file can be printed using the PRINT utility (see the VS Utilities Reference).
O (On-line)	Print output is sent directly to the designated on-line printer. The output is neither stored on disk nor controlled by the spooling system.

The four print modes can be represented schematically in Figure 1-4.

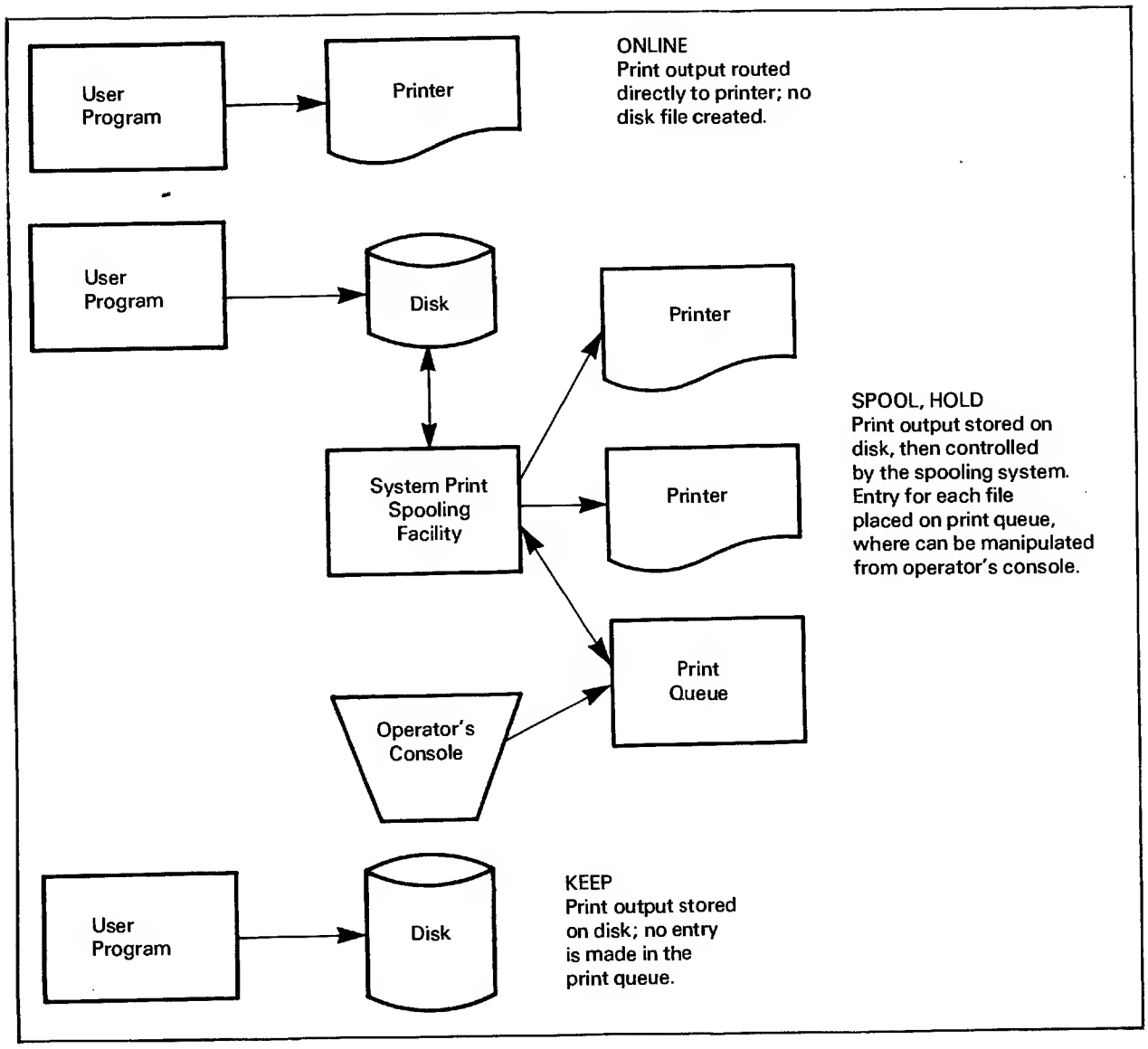


Figure 1-4. Schematic Representation of Print Modes

A user can set a default print mode value for the current workstation session via the SET USAGE CONSTANTS command of the Command Processor. This default value then is used for all print output created by default; for example, if the default print mode is H, all print output created during such routines as compilation would be stored on disk as print files and their entries held on the print queue until acted upon by a user. For print output not created by default or for which no default print mode exists, the user can specify a print mode when the file is created.

As with print modes, the user can specify a print file name and location for any stored print files not created by default. Each print file not supplied a file name by the user is assigned a unique name by the system, and is placed in a print file library created by the system unique to that user (see Appendix C, "VS Naming Conventions," for information on the names of these files and libraries).

For more information on print modes and the print queue, consult Subsection 3.7.1, "Controlling the Print Queue." For further discussion of print files and print spooling, see the VS System Operation Guide.

1.9 DEFAULT PARAMETER SPECIFICATION AND THE SYSTEM PROGRAM LIBRARY

The system minimizes the number of keystrokes required to specify run-time parameters for system functions and utilities by automatically supplying default parameters wherever possible. This approach saves the user time and reduces the possibility of typing errors. Whenever a prompt requesting parameters is displayed, all default values are also displayed for the user's inspection. Parameters may be left with their default values, or they may be changed in place by typing in new values. The users, therefore, always have the option of accepting the displayed defaults provided or specifying their own parameters.

1.9.1 Specifying Usage Constants

Default values for certain commonly used parameters called usage constants can be specified by the user with the SET USAGE CONSTANTS command. This command, invoked with PF2 from the Command Processor menu, permits the specification of default names for commonly used libraries and volumes. SET USAGE CONSTANTS also permits the user to specify a default file protection class, various print mode options, and certain background job submittal parameters. Whenever prompts requesting specification of any parameters for which default values have been specified via SET USAGE CONSTANTS are encountered, the specified default values are displayed in the prompts. (For further information, consult Section 3.4, "SET USAGE CONSTANTS.")

For example, whenever an attempt is made to open a file, a file specification prompt is displayed, requesting the user to enter the file name along with the names of the library and volume to which the file is assigned. If default libraries and volume names have been specified with SET USAGE CONSTANTS, the appropriate names are automatically supplied as defaults in the prompt. If the file to be opened is an output file, the default names for the output library and output volume are supplied; if an input file is to be opened, the default names for the input library and input volume are supplied, etc. In every case, the default names can be modified by the user when the prompt is displayed.

1.9.2 The System Program Library

In the special case of system program files, an additional level of defaultability is provided by the system (after any SET USAGE CONSTANTS values have been examined). System programs are assigned to the System Program Library which always resides on the system volume. The System Program Library and Volume are used automatically as defaults by the RUN command whenever the named program cannot be found in the specified user library and whenever no other library name is supplied. (Note that the names of the System Program Library and its associated volume are not displayed in the RUN prompt; when no user library or volume is supplied, the library and volume name fields remain blank.) Thus, when a system program is run, it is necessary to supply only the program file name; the names of the library and volume may be omitted, and the system will automatically use the System Program Library. This feature permits the user to run system utility programs without specifying a library or volume name, indeed, without ever having to know those names.

If the user has specified default names for program library and volume via SET USAGE CONSTANTS, these names need not be changed or erased when running a system utility program. The RUN command first checks the user program library for the specified program. If the program is not found there, RUN then automatically checks the System Program Library. A system utility program may therefore be run without entering a program library or volume name, whether or not user-specified defaults for these names appear in the RUN prompt (if the file name is not listed in the user's library, if displayed).

1.10 FILE SECURITY

The VS security system provides a multilevel security system for the protection of both system and individual files. On the system level, access is restricted to users having LOGON rights. Volume access also can be restricted by mounting a volume exclusively. On the file level, the system provides for the establishment of a number of different file protection classes to which individual program and data files can be assigned. Each system user then is granted access rights to one or more of the defined file protection classes by a system security administrator. Users can obtain access only to files in the protection class or classes to which they have access rights. System security administrators thus have great latitude in determining which users will have access to particular files.

The security system is documented for system security administrators in a separate manual, the VS System Management Guide. For the programmer, a general understanding of how the security system works is provided below, since the programmer must assign files to appropriate file protection classes when those files are created.

1.10.1 File Classes

The file class to which a file is assigned is designated by a 1-character file class protection code. The system provides a total of 30 unique file class codes. These codes are:

- Letters of the alphabet (A - Z)
- Space ( )
- Number sign (#)
- Currency symbol ($)
- At sign (@)

File classes associated with the letters A - Z are defined by system security administrators and are therefore unique for each installation. File classes associated with the space, number sign, currency symbol and at sign are defined by the system and are the same in all installations. The file class associated with the space is the unprotected class; all system users, irrespective of their designated access rights, have access to files in this class. The file class associated with the number sign is the private class; only the file's owner of record (i.e., the user who created the file) and system security administrators can access a file in this class. All other users are prevented from accessing such a file, irrespective of their designated access rights. The file associated with the currency symbol provides read-only access; all users may read and execute the file, but only the owner of record and system security administrators can write to it. The file associated with the at sign permits execute-only access; all users may execute the file, but only the owner of record and system security administrators can read it or write to it.

1.10.2 User Access Rights

At the time a user is assigned a User ID and password, a system security administrator determines which file classes will be accessible to that user. A user, for example, may be granted access only to file classes A, B, and C, or X, Y, and Z. (The meanings and limitations of these classes must be predefined by the administrator at each installation.) Whenever a new file is created, one of the parameters requested is the FILECLAS for that file. FILECLAS is a 1-character field into which a file class code is entered. The default value for this field can be specified with the SET USAGE CONSTANTS command. If not specified, the value is blank ( ); thus, files not assigned to specific file classes are unprotected (accessible to all users).

Once a file has been assigned to a file class, only users with access rights to that class and the file's owner of record can obtain access to the file. A file can be reassigned to another class only by the owner of record or a system security administrator. The PROTECT option of MANAGE FILES/LIBRARIES can be used to modify the FILECLAS parameter of a file and assign the file to a different file class. Within a file protection class, various levels of access rights can be defined, including execute access, read-only access, and write access. If a user attempts to perform an operation on a file which is not permitted under that user's access rights, the system displays an error warning and terminates the attempted access operation.

1.10.3 Program Access Rights

Programs, like users, may access only those files to which they have access rights. By default, programs have no access rights unless such rights are explicitly assigned by a system security administrator. In normal execution, therefore, a running program can only access those file classes to which the user has access rights. However, in some cases, it is desirable to grant special access rights to a program independent of those held by the user who runs the program. (A program used to back up disk files, for example, must be able to read all files.) For such cases, a system security administrator must grant access privileges to the program via the SECURITY utility (see the VS System Management Guide).

An executing program which has been granted special access rights assumes both its own access rights plus those of its user while the program is running. (The user, however, cannot carry the program's rights outside of the program, say, to the Modified Command Processor.) Thus, if a user with access rights to file classes A, B, and C runs a program which has access rights to file class D and the program attempts to open a data file in class D, the file can be opened. However, a file in file class E cannot be opened since neither the user nor the program have access rights file class E, and the system displays an error message if access is attempted.

1.11 BACKGROUND PROCESSING

In addition to interactive processing, the VS provides a noninteractive, background processing environment. A background job consists of one or more programs and procedures run without user intervention by a controlling procedure. (For a discussion of procedures, see the VS Procedure Language Reference.) Background jobs are submitted directly from the Command Processor or by a user-written Assembler language routine, and they are run on a completely time-independent, noninteractive basis. Once submitted, a background job is transferred to the control of the system, which places an entry for that job on a list of background jobs called the procedure queue. The workstation from which the job was submitted is thus freed for interactive operation or for submittal of more background jobs. Background jobs are run one at a time and are not associated with any workstation. Since they are noninteractive, background jobs must be fully parameterized (i.e., no workstation I/O transactions may be attempted by any background job).

Background processing permits job execution without requiring either user intervention or a committed workstation, thus freeing the workstation for interactive operations while background jobs are executing. Background processing is therefore particularly useful for jobs, such as data sorting and report generation, that can be fully parameterized and normally require long periods of noninteractive workstation time.

1.11.1 Background Procedures

All background jobs run on the VS must be controlled by procedures. A procedure is a set of commands written in the VS Procedure language (see the VS Procedure Language Reference). A background procedure runs one or more background programs and supplies all parameters required for those programs. The use of procedures in background processing permits related programs to be executed in a specified order as one job.

All available procedure statements can be used in background procedures; however, since background jobs are noninteractive, a background job cannot attempt to generate a screen transaction. Therefore, all programs run by a background procedure must be fully parameterized. Any background program attempting workstation I/O results in immediate abnormal termination of that background job.

1.11.2 Submitting a Job

Background jobs are submitted by any user via the SUBMIT PROCEDURE command (PF12) on the Command Processor Menu or the SUBMIT SVC in an Assembler program. To submit a job, the user specifies the name, library, and volume of the controlling procedure for the job, as well as certain other parameters concerning its execution, including a dump specification, a CPU time limit, and whether the job will be run automatically or held on the Procedure Queue until released for execution by the user. (See Section 3.13, "SUBMIT PROCEDURE" for detailed explanations of these job submission options.) All aspects of the job request, such as checks on the user's access privileges, are validated when the job is submitted. Programs or commands executed as part of a background job receive the same access rights as those of the submitting user.

1.11.3 The Procedure Queue

Once submitted for background processing, a job is transferred to the control of the system, which places an entry for that job onto the procedure queue. The procedure queue is a list of all submitted background jobs, and includes specific information concerning each submitted job. As with print files in the print queue, jobs in the procedure queue are either run automatically by the system, or held in the queue until released for execution by the user, depending upon the specific status of the job. The procedure queue is accessible to all users through PF4 from the Command Processor menu for user workstations and through the Operator's Console menu for dual mode or dedicated operator workstations.

In user mode, a user can modify certain characteristics of procedure queue entries for jobs submitted by that user. A user cannot, however, modify the entries for jobs submitted by other users. Among other things, a user may lower (but not raise) the position of his or her jobs on the queue - a capability which permits users to determine the relative sequence in which their own jobs will be run. Manipulation of the entire procedure queue is possible only from the Operator's Console menu in operator mode. (See the VS System Operation Guide for a discussion of the procedure queue manipulation facilities available in operator mode.)

1.11.4 Job Termination

A background job runs to completion unless it is cancelled due to the occurrence of one of several special conditions, listed below. Upon normal termination, a job is normally removed from the queue; (although it is possible to specify that a job be automatically requeued after it is run; see Subsection 3.7.2, "Controlling the Procedure Queue"), and any printer output produced by the job is placed in the Print Queue. Abnormal termination can occur in any of the following ways:

1. Automatically, due to attempted workstation I/O.

2. Automatically, due to an exit specified within a program run by the procedure.

3. Via operator command, due to a possession conflict.

4. Via operator command, due to a specified volume which was not mounted when opening a file.

5. Optionally by the operator from the Noninteractive Task display on the Operator's Console menu (see the VS System Operation Guide).

6. Either automatically or optionally, due to a CPU time limit imposed at the time the job was submitted.

For all abnormal job termination, a one-page "indicative" dump is automatically spooled to a printer. This dump contains debug information similar to that of the interactive debug processor screen (see the VS Program Development Tools manual). It is also possible to request that a full dump be printed upon abnormal termination of the job (see Section 3.13, "SUBMIT PROCEDURE.")

This manual is updated by:
Addendum 800-1101PI-05.01

1.12 VS INFO ON-LINE HELP AND INFORMATION FACILITY

As an aid to the user, certain Wang VS documents have been packaged and installed on the VS system as an on-line documentation set. This documentation consists of how-to procedures for specific software functions and reference information on the VS itself. VS INFO is a software facility designed to access this on-line documentation. With VS INFO, a user can select a document, view its contents sequentially, locate specific text references or sections within the document, or select an alternate document.

In addition to running as a standalone facility, VS INFO is designed to be accessed from currently running programs. This feature allows a user to refer directly to VS INFO documentation concerning a program function while running the program. To implement this feature, the program must be documented in VS INFO, and VS INFO must be linked to the program.

1.12.1 Running VS INFO

VS INFO can be run interactively from the Command Processor or from within a program modified to allow access to VS INFO. The user runs VS INFO from the Command Processor by pressing PF1 and entering the program name INFO. At present, VS INFO is designed to run from within a program by pressing a designated HELP key. The following paragraphs describe the procedure for using the VS INFO facility.

Topic Selection

Documents attached to VS INFO are listed by topic. Once VS INFO is running, the first screen to appear is the Topic Selection menu (see Figure 1-5). This menu displays the titles of all documents currently attached to the VS INFO facility. From this menu, the user accesses all documents attached to the VS INFO facility and invokes all available VS INFO functions.

To access a document, the user can either key in the entire title or unique prefix of a document and press ENTER, or position the cursor beside the selected document on the menu and press ENTER. A unique prefix must clearly define a specific topic heading. For example, if the topics PROC and PROCEDURE are listed, PRO cannot be used as a unique prefix for either topic because it defines both topics. In this case, PROC is a unique prefix for the PROC topic and PROCE is unique for PROCEDURE. Once the user presses ENTER, the Display mode screen appears.

Alternatively, the user can select the Special Function menu by pressing PF10 or request further data on the VS INFO facility by pressing PF13. PF Key functions available from the Topic Selection screen are as follows.

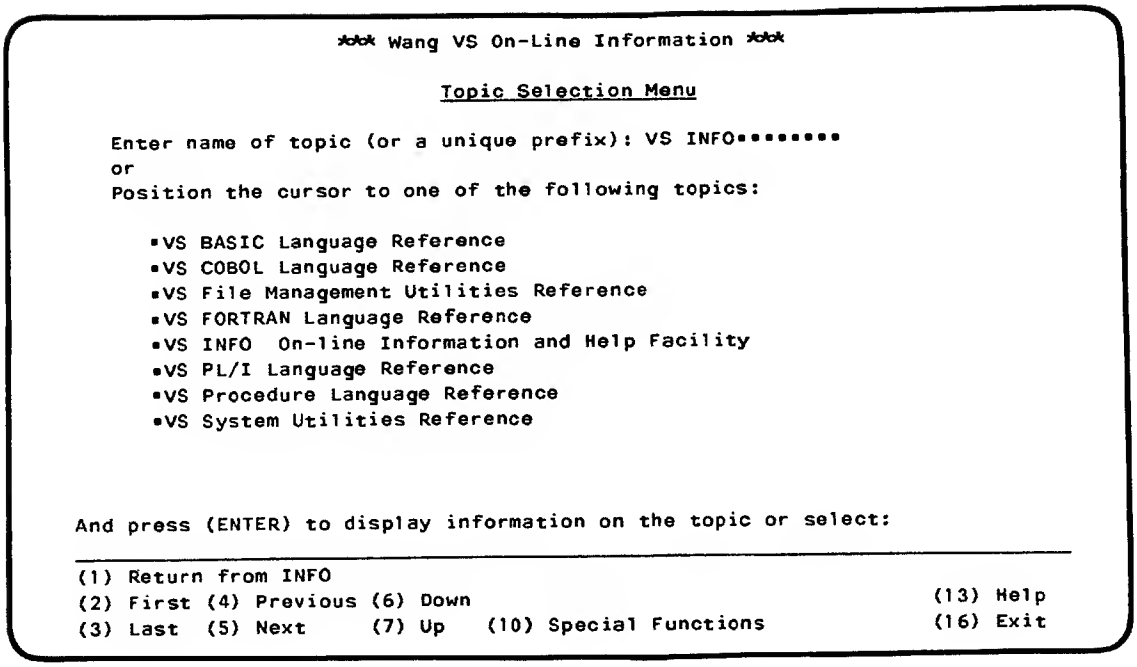


Figure 1-5. Sample Topic Selection Menu

PF1 Return From VS INFO--Exits from VS INFO. If VS INFO was invoked from a program, returns the user to the program. If not, returns the user to the Command Processor.

PF2 First--Displays the first screen of VS INFO topics when pressed. Displays as an option only if the document topics list requires more than one screen.

PF3 Last--The converse of PF2. Displays the last screen of VS INFO topics when pressed. As with First, Last displays as an option only if the document topics list requires more than one screen.

PF4 Previous--If VS INFO topics exceed one screen and the user is not in the first screen, pressing PF4 displays the previous screen.

PF5 Next--Displays the next screen of available topics if the topic list exceeds one screen.

PF6 Down--Causes the topic list to scroll down one line at a time.

PF7 Up--Causes the topic list to scroll up one line at a time.

PF10 Special Functions--Transfers the user to the Special Function menu.

PF13 Help--Displays information from the VS INFO on-line document concerning the Topic Selection menu.

PF16 Exit--Same as PF1, exits from the VS INFO facility.

Display Mode

Display mode is the means by which a user views an on-line document. It is run from the Topic Selection menu by pressing ENTER as described above. The initial Display mode screen (see Figure 1-6) is divided into four areas: a header line containing the document title, a six-line table of contents (T of C) window, a twelve-line text window, and a five-line menu field. By pressing the appropriate PF keys, a user can convert the display to a two-area format consisting of 18 text or T of C lines and the five-line menu field.

The user can manipulate the data contained in the text and T of C windows but cannot change or modify the data in any way. Window contents can be scrolled up or down or paged from beginning to end. Document contents can be referenced by section numbers or by keywords found in the text. The menu cannot be manipulated in any way; it is a permanent part of the Display mode screen.

Many Display mode functions are cursor-dependent, which means that in order to perform certain tasks the user must position the cursor in a specific screen area. For example, to display text full screen, the user must position the cursor in the text window before pressing the appropriate PF key.

A unique feature of VS INFO is the highlighting in the T of C window of the section number and title corresponding to the text being displayed in the text window. This provides a convenient reference for the user when the section number of the text being displayed scrolls out of view.

```
      *** Wang VS Info for VS INFO  On-line Information and Help Facility ***
1.1     VS INFO ON-LINE HELP AND INFORMATION FACILITY
1.1.1   Running VS INFO
1.1.2   Topic Selection
1.1.3   Display Mode
1.1.4   Special Functions

1.1  VS INFO ON-LINE HELP AND INFORMATION FACILITY

     As an aid to the user, certain Wang VS documents have been packaged and
installed  on  the  VS  system as an on-line documentation set.  This
documentation consists of how-to procedures for specific software functions
and reference information on the VS itself.  VS INFO is a software facility
designed to access this on-line documentation.  With VS INFO, a user can
select a document, view its contents sequentially, locate specific text
references or sections within the document, or select an alternate document.

     In addition to running as a standalone facility, VS INFO is designed to
be accessed from currently running programs.  This feature allows a user to

Position cursor and press (ENTER) to locate a section or topic, or Select:
(1) Return to Topic Menu      (8) Find..............................
(2) First (4) Prev (6) Down   (9) Full Screen          (11) Text    (13) Help
(3) Last  (5) Next (7) Up     (10) Table of Contents                 (16) Exit
```

Figure 1-6. Sample Display Mode Screen (Split Screen Mode)

In Display mode, a user can manipulate data in several different ways. PF key functions available in Display mode are as follows.

ENTER Performs two functions. By positioning the cursor under the first digit of a section number in the T of C window and pressing ENTER, the user can view the section contents in the text window. By positioning the cursor under the first digit of a referenced section number in the text window and pressing ENTER, the user can view the contents of the referenced section. In both cases, the T of C window is updated accordingly, with the new section number highlighted. Note that the cursor must be placed directly under the first digit to execute this move.

PF1 Return to Topic Selection Menu/Display/Section Number--Performs three functions. First, PF1 exits from Display mode to the Topic Selection menu. Second, if the user has referenced a topic from within another topic in the Display mode (by pressing PF13), PF 1 returns the user to the exit point in the original text. Third, if a user references a section from within another section (using ENTER), pressing PF1 causes the original text to display.

PF2 First--Performs two functions. When the cursor is positioned in the T of C window, pressing PF2 positions the first section number of the document in the T of C window. The text window is updated to reflect this change. When the cursor is positioned in the text window, pressing PF2 causes the text to scroll back to the beginning of the section currently being displayed. No change occurs in the T of C window.

PF3 Last--The converse of PF2. When the cursor is positioned in the T of C window, pressing PF3 positions the last section of the document in the T of C window. The text window is updated to reflect this change. When the cursor is positioned in the text window, pressing PF3 causes the text to scroll to the end of the section currently being displayed. No change occurs in the T of C window.

PF4 Prev--Performs two functions. When the cursor is positioned in the T of C window, PF4 causes the current T of C display to page out and the preceding T of C display (if there is one) to page in. The text window is updated to reflect this change. When the cursor is positioned in the text window, PF4 causes the current text display to page out and the preceding text display (if there is one) to page in. No change in the T of C takes place unless a new section number scrolls into the top line of the text window.

PF5 Next--The converse of PF4. When the cursor is positioned in the T of C window, PF5 causes the current T of C display to page out and the following T of C display (if there is one) to page in. The text window is updated to reflect this change. When the cursor is positioned in the text window, PF5 causes the current text display to page out and the following text display (if there is one) to page in. No change in the T of C takes place unless a new section number scrolls into the top line of the text window.

PF6 Down--When the cursor is positioned in the T of C window, PF6 causes the T of C display to scroll down one line at a time. The text window is updated to reflect this change. When the cursor is positioned in the text window, pressing PF6 causes the text display to scroll down one line at a time. No change occurs in the T of C unless a new section scrolls into the top line of the text window.

PF7 Up--The converse of PF6. When the cursor is positioned in the T of C window, PF7 causes the T of C display to scroll up one line at a time. The text window is updated to reflect this change. When the cursor is positioned in the text window, PF7 causes the text display to scroll up one line at a time. No change occurs in the T of C unless a new section scrolls into the top line of the text window.

PF8 Find (32 pseudoblanks)--Allows the user to search for a specific text string or section number as defined by the contents of the pseudoblank field. If a user enters a section number in the pseudoblank field and presses PF8, the section number, if it exists, appears highlighted in the T of C window and the text appears in the text window. If a text string is specified in the pseudoblank field, VS INFO does a forward search only. If the string is found, both the T of C and text windows are updated accordingly. If a search is unsuccessful, the message "SORRY - can't find it." appears in the top left corner of the screen.

PF9 Full Screen/Split Screen--Allows the user to alter the screen display according to current screen status. If the screen is in the split mode, PF9 converts the screen to full mode. If the screen is in full mode, PF9 converts it to split mode. Display contents are determined by cursor position. If the cursor is in the T of C window of a split screen display, pressing PF9 causes a full screen display of the T of C. If the cursor is in the text window of a split screen, pressing PF9 causes a full screen display of text. During these changes, the menu display is unaffected.

PF10 Table of Contents--Allows the user to go from a full screen text display to a full screen T of C display when the screen is in the full mode. If the screen is in split mode and the cursor is in the text window, pressing PF10 positions the cursor at the first line of the T of C.

PF11 Text--Allows the user to go from a full screen T of C display to a full screen text display when the screen is in the full mode. If the screen is in split mode and the cursor is in the T of C window, pressing PF11 positions the cursor at the first text line.

PF13 Help--Causes that section of the VS INFO on-line document describing the Display mode to appear on the screen. Once in the VS INFO text, the user can exit it by pressing PF1.

PF16 Topics--Returns the user to the Topic Selection menu. From the Topic Selection menu, the user can select another document, exit from the VS INFO facility, or resume viewing the selected topic.

Special Functions

As part of VS INFO, a Special Function menu is provided that enables the user to attach alternate topic libraries to VS INFO or regenerate the topic directory file. Pressing PF10 in the Topic Selection menu causes the Special Function screen to appear (see Figure 1-7).

To specify an alternate topic library, the user keys in the desired library and volume names in the proper screen fields and presses ENTER. Leaving the fields blank and pressing ENTER causes VS INFO to default to the system topic library. Functions available to the user from the Special Function menu are invoked through the use of PF keys. These functions are defined as follows.

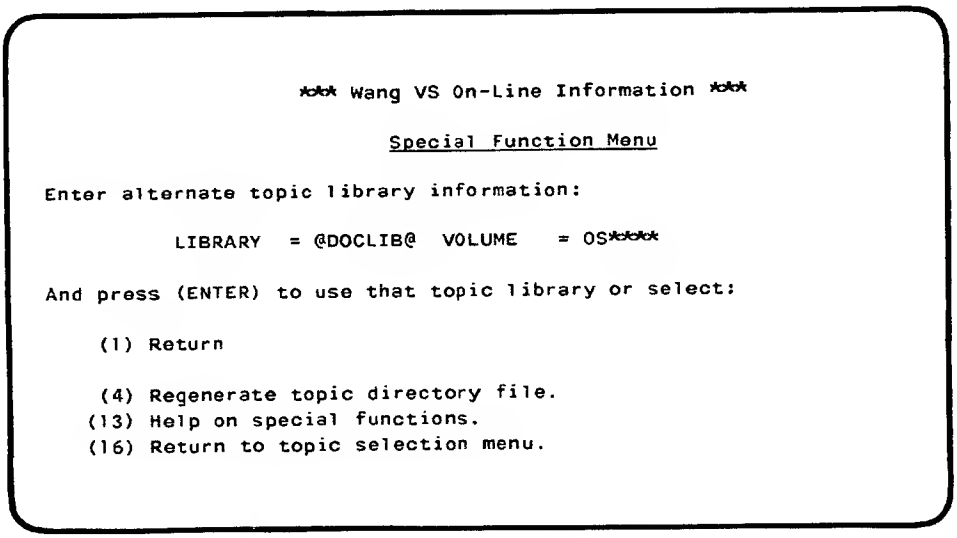


Figure 1-7. Sample Special Function Menu Screen

PF1 Return--Returns to the Topic Selection menu.

PF4 Regenerate Topic Directory File--Allows the user to regenerate a topic directory file; default is the system topic library. If topics have been added to or deleted from a topic library, this function must be used to update the topic directory file. If this is not done, the Topic Selection menu does not display an accurate document list and access to new documents is not possible. If a document has been deleted and the directory file is not updated, the Topic Selection menu continues to display the deleted document. If the user attempts to view the deleted document, VS INFO stops and the system displays an error message.

PF13 Help--Causes that section of the VS INFO on-line document concerning the Special Function menu to appear on-screen.

PF16 Return to Topic Selection Menu--Functions the same as PF1.

CHAPTER 2
THE VS WORKSTATION

2.1 INTRODUCTION

The VS workstation is an interactive terminal which permits the user to communicate in a conversational manner with a running program on the VS. The workstation is a console unit composed of two parts: a CRT screen, used by the program to communicate information to the user, and a keyboard, used by the user to enter information and satisfy system prompts (shown in Figure 2-1, The VS Data Processing Workstation Keyboard). This chapter provides an operational overview of the workstation; its intent is to give the user enough information to communicate with the system and run programs from the workstation. All VS compiler languages offer special extensions for formatting the workstation screen and receiving user-entered data; such extensions are described in the individual language manuals.

2.2 THE CRT

The workstation screen is capable of displaying 24 rows of 80 characters each. (See Appendix A for the complete set of displayable characters.) A special symbol, resembling a blinking underscore and called the cursor, is displayed beneath a character position to indicate where the next character entered from the keyboard will be displayed. If the cursor does not appear on the screen, the keyboard is locked and nothing can be entered.

2.2.1 Screen Formatting

One of the more important features of the workstation screen is the screen's ability to be formatted into distinct fields. A field is a discrete region of the screen which may be assigned specific attributes. Some of the attributes which may be specified for a field (one for each column for a given field) are summarized below:

Protection	Display Intensity	Usage	Underscore
modifiable protected	bright dim blinking no-display	alphanumeric (upper/lowercase) alphanumeric (uppercase only) alphanumeric (lowercase only) numeric only	line no line

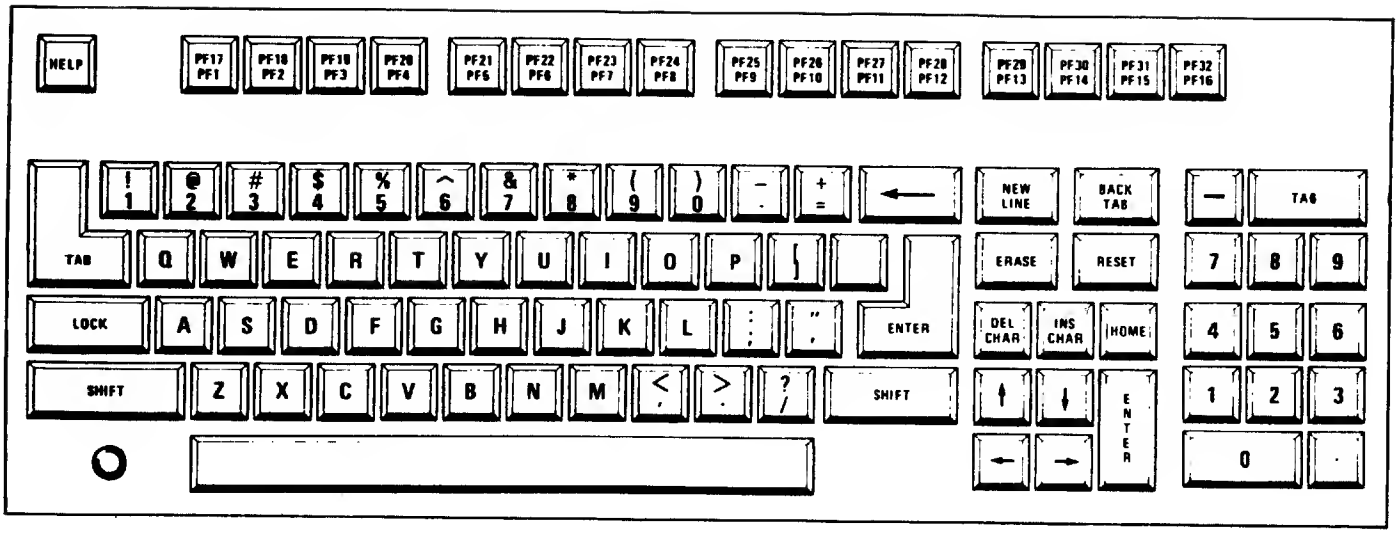


Figure 2-1. The VS Data Processing Workstation Keyboard

Under program control, fields can be defined on the screen, using special field control characters called Field Attribute Characters (FACs). By convention, field attributes are set in the following manner:

Protected fields	In all system menus and prompts, protected fields are displayed with low intensity. Protected fields are used to display information or instructions for the user.
Modifiable fields	Modifiable fields are displayed with high intensity. In addition, all blank characters are displayed as pseudoblanks (solid blocks). Modifiable fields are used to receive user entry. As data is keyed into a modifiable field, the default values and/or pseudoblanks are replaced by the entered characters.
Blinking	Modifiable fields are blinked to indicate a field in error. Protected fields are sometimes blinked to call attention to error messages.

2.2.2 Tabs

There are a total of 10 tabs, which can be set to any column on the workstation screen. The tabs can be set and reset by a system program or an application program and, for certain programs, are modifiable by the user. Tabs can also be set manually by the user for text entry applications with the SET TABS option of the Editor program. Default tabs are set automatically by the Editor for each language (see the VS Program Development Tools manual).

2.2.3 Audio Alarm

A short beep is sounded whenever an illegal keying operation is attempted. Illegal operations include attempts to enter data in a protected field, to move the cursor beyond the screen with a field-sensitive key, or to enter data while the keyboard is locked. The audio alarm is under program control and may thus be sounded by an application program whenever the programmer wishes to alert the user.

2.2.4 Visual Controls

Two knobs, located to the right of the workstation screen, permit user modification of screen display intensity (brightness) and screen character contrast (contrast).

2.3 THE KEYBOARD

The workstation keyboard is the user's primary means of communicating information to the system (see Figure 2.1, The VS Data Processing Workstation Keyboard). The keyboard keys are divided into the following functional groups:

- Data entry keys
- Cursor-positioning keys
- Special-purpose keys
- System communication keys

2.3.1 Data Entry Keys

The data entry keys provide the means for entering data at the current cursor position on the screen. The cursor must, however, be positioned within a modifiable field; otherwise, the keystroke is not honored and the alarm is sounded. The keys in this group include:

Normal Character Keys	Include the letters, numbers, and special characters. In general, these keys function exactly as typewriter keys; SHIFT and LOCK can be used to obtain uppercase symbols. If the cursor is positioned in a numeric-only field and any key other than (0 - 9), (-), or (.) is struck, the alarm sounds and the keystroke is rejected. When the cursor is in the last position of a field and one of the character keys is struck, the character is entered at that location and the cursor is automatically positioned at the next modifiable field (even if this involves skipping one or more lines or columns).
ERASE	Sets to blanks the cursor location and all locations following it within the same field. Locations preceding the cursor are not changed. The cursor is not moved.

INS (insert) CHAR	Inserts a blank in the display at the current cursor position and automatically shifts all characters in the current field one location to the right, starting at the current cursor position. If the last character in the field is a blank or pseudoblank, this character is lost. If the last character is not a blank or pseudoblank, the keystroke is not honored and the alarm sounds.
DEL (delete) CHAR	Deletes the character at the current cursor position and shifts all characters in the field one location to the left after the current position. A blank is inserted in the last position in the field.

2.3.2 Cursor-Positioning Keys

Cursor-positioning keys are used to move the cursor to a desired location on the screen. They consist of two types: non-field-sensitive and field-sensitive.

Non-Field-Sensitive Cursor-Positioning Keys

These keys position the cursor without regard for the presence of particular fields. They can be used to position the cursor at any location on the screen. There are four keys in this group; all provide the automatic repeat feature, which causes keystrokes to be entered continually while the key is pressed:

Up arrow	Moves the cursor up one row in the same column. If positioned in the top row, the cursor moves to the bottom row in the same column.
Down arrow	Moves the cursor down one row in the same column. If positioned in the bottom row, the cursor moves to the top row in the same column.
Right arrow	Moves the cursor one location to the right in the same row. If positioned at the end of a row, the cursor moves to the beginning of the next row. If positioned at the end of the bottom row, it moves to the beginning of the top row.
Left arrow	Moves the cursor one location to the left in the same row. If positioned at the beginning of a row, the cursor moves to the end of the preceding row. If positioned at the beginning of the top row, it moves to the end of the bottom row.

Field-Sensitive Cursor-Positioning Keys

These keys normally move the cursor two or more positions with a single keystroke. They are used to position the cursor at a new field or new line; they are especially useful in data entry, since they always position the cursor at a modifiable location. There are four keys in this group:

TAB — Positions the cursor at the next tabable position on the screen. A tabable position is either the first character of a modifiable field, a preset tab column within a modifiable field, or the first character of a protected numeric-only field. If the cursor is positioned at the last tabable location on the screen, the alarm sounds and the cursor does not move.

BACK TAB — Positions the cursor at the closest first byte of a modifiable field preceding the current cursor location. If the cursor is in a modifiable field and in other than the first location, the cursor moves to the start of that field. If there is no preceding modifiable location, the alarm sounds and the cursor does not move.

NEW LINE — Advances to the first position of the next line and positions the cursor at the first modifiable position at or following the start of the line. The cursor may therefore be positioned several lines from the original position. If there is no modifiable location at or following the start of the next line, the alarm sounds and the cursor does not move.

HOME — Positions the cursor at the first modifiable location on the screen. If there is no modifiable location on the screen, the alarm sounds and the cursor does not move.

2.3.3 Special-Purpose Keys

There are three keys used for special, noncategorized actions:

SHIFT — Causes basically the same action as it does on a typewriter. For keys with uppercase and lowercase characters on the key face, SHIFT always determines which of the two characters is entered. For keys with only a single character on the key face, SHIFT has no effect.

SHIFT also has no effect when letters are entered into a field designated as uppercase only. In this instance, uppercase letters are entered irrespective of whether SHIFT is pressed. A small lamp immediately to the left of SHIFT is lighted whenever SHIFT is pressed. Pressing SHIFT when the keyboard is locked in uppercase turns the SHIFT lamp off and unshifts the keyboard.

LOCK — Causes the keyboard to behave as if SHIFT is continuously pressed. When pressed, LOCK causes the SHIFT lamp to be lighted. Pressing LOCK again does not unlock the keyboard; pressing SHIFT, however, turns off the SHIFT lamp and unlocks the keyboard.

RESET — Causes all Field Attribute Characters on the screen with a blink indication to be reset to high-intensity, nonblinking. RESET is effective even when the keyboard is locked.

2.3.4 System Communication Keys

All the keys thus far discussed operate exclusively on the contents of the workstation screen; in no case do they affect the contents of memory or any external files. A special group of keys enables the user to communicate interactively with the system, indicate that the controlling program may now process the data entered, or request special assistance from the system. Each of these special keys presents an interrupt to the system, requesting the system to service the workstation at once. In addition, a special control character called Assistance ID (AID) is generated by each of the system communication keys. This character identifies the key used to initiate the interrupt. It can be examined under program control.

When a system communication key is pressed, all keys (except RESET and HELP) are locked and the cursor is removed from the screen. If any one of the locked keys is pressed, the alarm sounds. The system communication keys are:

ENTER — The normal means of terminating user entry and requesting the program to process data. SHIFT does not affect the action of ENTER, and ENTER is not honored while the keyboard data entry keys are locked.

PROGRAM FUNCTION (PF) — The 16 PF keys act the same as the ENTER key, except that each key generates a unique character. A controlling program can therefore examine the character to determine which PF key was struck. The values of the PF keys are affected by SHIFT: the lowercase values are PF1 - PF16 and the uppercase values, PF17 - PF32.

HELP — Always invokes the Command Processor menu on a user workstation. HELP remains active even when the data entry keys are locked and may be used at any time to interrupt a running program and obtain access to the Command Processor menu. (HELP is not active if the user has been HELP-disabled by an operator or a system security administrator; see the VS System Management Guide and the VS System Operation Guide.) HELP does not alter the status of the interrupted program, nor does it cause information which has been entered into the display to be released for processing. (The screen contents are saved in a work buffer and returned to the screen when normal processing is resumed.)

CHAPTER 3
THE COMMAND PROCESSOR

3.1 INTRODUCTION

The user communicates with the VS by means of commands, which can be either issued interactively from the workstation or written in a program-like sequence of statements called a procedure. Interactive communication from the workstation involves issuing commands through the Command Processor. These commands are the subject of this chapter.

To communicate interactively with the system, the user selects commands from the Command Processor menu. This menu contains a description of each available command and assigns each one to a Program Function (PF) key. To issue a command, simply press the appropriate PF key.

Pressing a PF key executes the associated command. Then, the system displays prompts which request parameters required for that command. The system provides defaults for many parameters, and the user can leave them unchanged or modify them on the screen. When the parameters specified in a prompt are acceptable, the user simply presses ENTER to pass those parameters to the system.

The commands available from the Command Processor menu permit the user to initiate a variety of functions including:

- Interactively running both user and system programs.
- Continuing or cancelling program execution.
- Setting default parameters.
- Controlling print and procedure queues.
- Locating, protecting, scratching, and renaming files and libraries.
- Examining and modifying the use of system resources.
- Managing all devices available to the system.
- Entering Word Processing if you have word processing software.
- Entering Operator mode if you have a dual mode workstation.
- Submitting background jobs.
- Printing program and command screens.
- Performing debug processing.
- Logging off the system.

However, the commands that perform these functions are not all available at the same time. There are two slightly different versions of the Command Processor menu:

1. The Main menu first appears following the Logon procedure; it also appears after the completion of any program, procedure, or command.

2. The Modified menu is displayed whenever a program is interrupted.

Figures 3-1 and 3-2 illustrate these two menus.

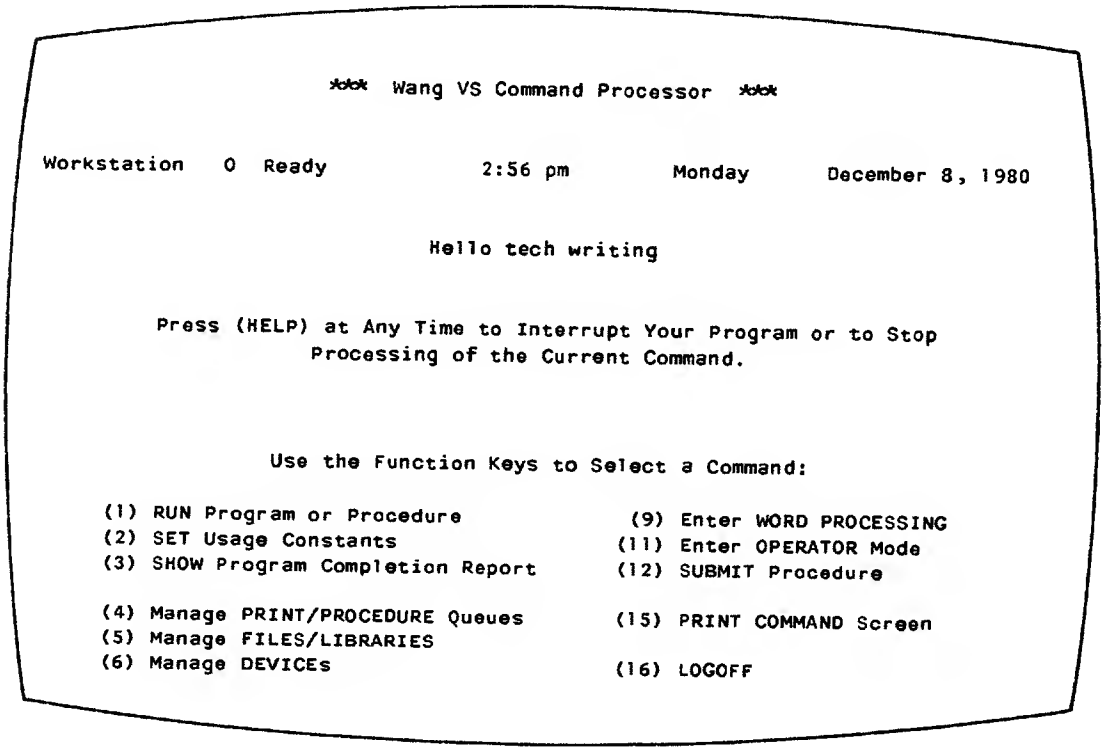


Figure 3-1. Main Command Processor Menu

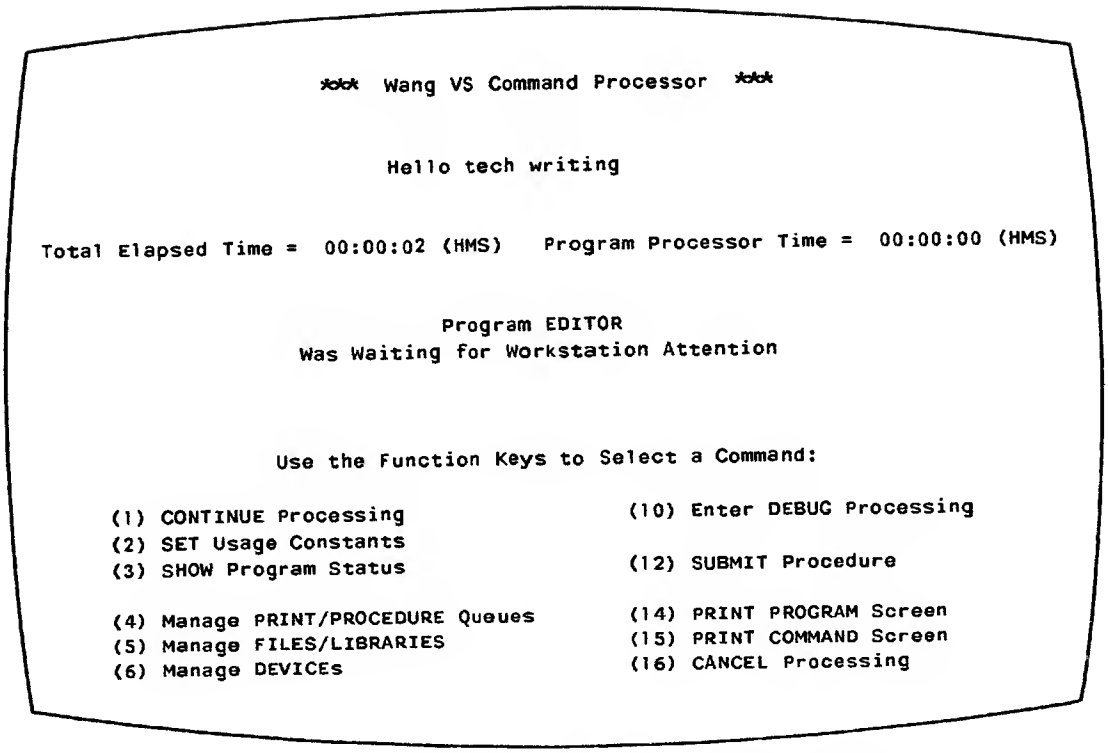


Figure 3-2. Modified Command Processor Menu

The Modified menu differs from the Main menu in the commands issued from five separate PF keys. In the Main menu, the RUN PROGRAM OR PROCEDURE command is assigned to PF1 and the LOGOFF command to PF16. In the Modified menu, CONTINUE PROCESSING replaces RUN PROGRAM OR PROCEDURE, and CANCEL PROCESSING replaces LOGOFF. Consequently, it is impossible to run another program or log off the system while a program is suspended. Similarly, PF3 on the Main menu displays SHOW PROGRAM COMPLETION REPORT; on the Modified menu, it displays SHOW PROGRAM STATUS for an interrupted program. The Modified menu also provides two additional commands: ENTER DEBUG PROCESSING, which initiates debug processing on interrupted programs, and PRINT PROGRAM SCREEN, which allows the user to obtain a hard copy of an interrupted program's current screen. ENTER WORD PROCESSING, which is assigned to PF 9 on the Main menu, does not appear on the Modified menu.

On dual mode workstations, the command associated with PF11 on both the Main and Modified menus is ENTER OPERATOR MODE. Operator mode is introduced in Section 3.12, "ENTER OPERATOR MODE," and documented in the VS System Operation Guide.

All the commands on both menus are discussed in the order of their PF keys in the following sections of this chapter.

3.2 RUN PROGRAM OR PROCEDURE

RUN PROGRAM OR PROCEDURE is associated with PF1 on the Main Command Processor menu. This command runs a user or system program or procedure; it also loads a program for interactive debugging.

When you press PF1, the system displays a screen requesting information necessary to identify the program or procedure; Figure 3-3 illustrates this screen. You supply the following parameters (unless defaults were already set):

PROGRAM	The name of the program object file or procedure
LIBRARY	The name of the library containing the specified program file
VOLUME	The name of the volume containing the specified library

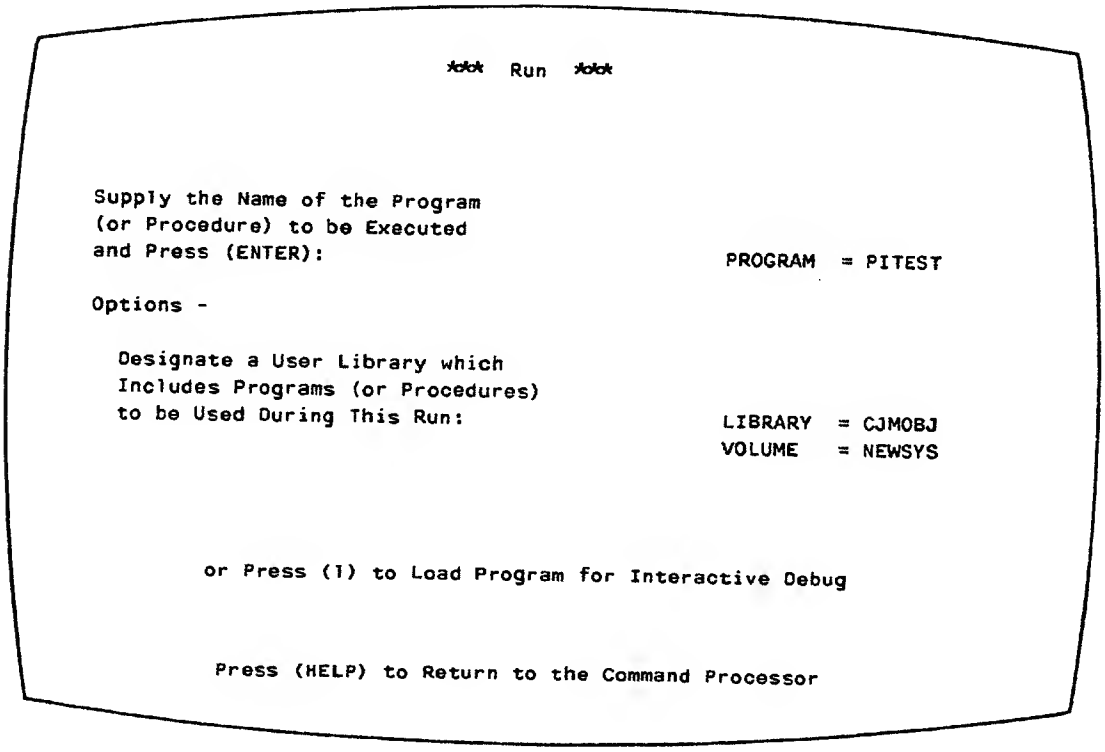


Figure 3-3. RUN PROGRAM OR PROCEDURE Screen Format

For user programs, you must enter the names of the library and volume containing the program file. If you used the SET USAGE CONSTANTS command (described below) to specify values for RUNLIB and RUNVOL, these values will appear as default parameters for this command.

For system programs, you need not specify library and volume names; you may either leave these parameters blank or ignore any defaults that appear. When executing these Run commands, the system searches for the program first in the specified library, if one exists. If it cannot find the program there or if no library is indicated, the system searches the System Program Library. All system programs are in this library; therefore, the system can locate them regardless of the library and volume specifications.

If you specify a volume and library, the volume must be mounted, and the library must exist on that volume.

Once the file, library, and volume names are established, you may choose to run the object file by pressing ENTER or to load the file for debug processing by pressing PF1. PF1 links you directly into the VS debug facility, which is described in the VS Program Development Tools manual.

3.3 CONTINUE PROCESSING

CONTINUE PROCESSING is associated with PF1 on the Modified Command Processor menu. This command resumes program execution from the point of interruption. Note that, because you cannot access the RUN PROGRAM OR PROCEDURE command from the Modified menu, it is impossible to run another program until you either run the interrupted program to completion or cancel it.

3.4 SET USAGE CONSTANTS

SET USAGE CONSTANTS is associated with PF2 on both Command Processor menus. This command permits you to:

1. Designate default names used during interactive processing for commonly specified libraries and their associated volumes, and assign a default file protection class.

2. Specify print mode options.

3. Specify background job (procedure) submittal defaults.

The system uses the default values assigned with SET USAGE CONSTANTS for the duration of the workstation session, until you respecify them, or until a procedure alters them.

3.4.1 File Defaults

The first screen displayed from SET USAGE CONSTANTS is the SET FILE DEFAULTS display. It allows you to specify default values for several libraries and volumes, and for a default file protection class. These library and volume names and the file protection class subsequently appear as defaults whenever input is required for these parameters. For example, the specified INLIB name (see the following list) appears as the default library whenever an

input file is to be opened. When such defaults appear, you can change them by simply typing another name over it. If you do not specify a name for a particular library or volume, the system supplies no default when a file of that type is opened.

The SET FILE DEFAULTS screen, illustrated in Figure 3-4, allows you to assign the following default parameters:

INLIB	The default input library; appears when an input file will be opened
INVOL	The default input volume; appears when an input file will be opened
OUTLIB	The default output library; appears when an output file must be specified
OUTVOL	The default output volume; appears when an output file or library must be specified
RUNLIB	The default runtime library; appears when RUN PROGRAM OR PROCEDURE is to execute a file
RUNVOL	The default runtime volume; appears when RUN PROGRAM OR PROCEDURE is to execute a file
WORKVOL	The volume on which work files are located; work files are created on this volume only if sufficient space exists on the designated disk
SPOOLVOL	The volume on which system-created spool files are located; spool files are created on this volume only if sufficient space exists on the designated disk
FILECLAS	The file protection class assigned to all output files; may be A - Z, $, @, #, or ½ and can be changed when a file is opened (see Section 1.10, "File Security," for further information)

```
                    *** Set Common Usage Constants ***


Default Location (Library and Volume) of Files, Assuming that these Values are
not Parameterized via Procedure or Provided by the Program Itself:

      Input Files:              INLIB    =              INVOL    =
      Output Files:             OUTLIB   =              OUTVOL   =
      User Programs:            RUNLIB   =              RUNVOL   =
      Work/Temporary Files:     WORKLIB  = #CJMWORK     WORKVOL  =
      Spooled Print Files:      SPOOLIB  = #CJMPRT      SPOOLVOL =


Default File Protection Class for Output Files
(Use " ", "$", "@", "#", or "A" through "Z"):          FILECLAS = *


       Alter these Displayed Default Constants in Place and Press (ENTER)

       or Press  (1) Set Print Mode Defaults
                 (2) Set Procedure Submittal Defaults
               (HELP) Return to the Command Processor
```

Figure 3-4. SET FILE DEFAULTS Screen Format

No restriction exists on the types of files that can be stored in a library. The same library name can be specified for INLIB, OUTLIB, and RUNLIB, or different names can be specified for each. Similarly, the libraries can be placed on the same volume or on different volumes.

The system creates work and spool libraries, and SET USAGE CONSTANTS cannot change their names. However, SET USAGE CONSTANTS can designate the volume(s) on which these libraries are located. See Section 1.9, "Default Parameter Specification and the System Program Library," for more information. If space is not available for work or spool files on the specified volumes, the system automatically places these files on another volume. Also, if you specify a nonexistent volume for SPOOLVOL, the spooled files are lost and no message is displayed.

You cannot specify a name for your print library or for individual print files from the Command Processor. However, you can specify these names through the Procedure language. Refer to the VS Procedure Language Reference for more information.

The bottom of the SET FILE DEFAULTS screen contains a list of command options that allow you to set print mode defaults (PF1), set procedure (job) submittal defaults (PF2), or return to the Command Processor menu (HELP).

3.4.2 Print Mode Defaults

If you press PF1 from the SET FILE DEFAULTS screen, the system displays the SET PRINT MODE DEFAULTS screen. This screen allows you to specify default print mode parameters for spooled and on-line printing. These parameters determine how the operating system handles print files. Figure 3-5 illustrates the SET PRINT MODE DEFAULTS screen, and the following list explains the parameters:

PRNTMODE — Determines the manner in which the system handles print files. The following are the four options:

- H Hold mode
- S Spool mode
- K Keep mode
- O On-line mode

PRTCLASS — The default print class (A - Z) to which print files are assigned. Each printer is assigned certain print classes and will print only files in those classes. Therefore, a file's print class determines which printers can print it. Refer to the VS System Operation Guide for further discussion of print classes for spooled print files.

FORM# — The default form number (0 - 254) which indicates the form type to use for printing spool and hold files from a workstation. Each installation defines its own FORM# and, on this screen, this number serves only as a comment to the system operator. The default is 000.

PRINTER — The device number of the printer used for on-line printing. This parameter is meaningful only if the print mode is O (on-line). If the print mode is H (hold) or S (spool), the operating system selects the printer based on the printer priorities set through the Operator's Console (see the VS System Operation Guide).

LINES — The number of lines printed on each page. This parameter is for use only by user programs and certain system utilities. The values range from 0 to 255; the default is 55.

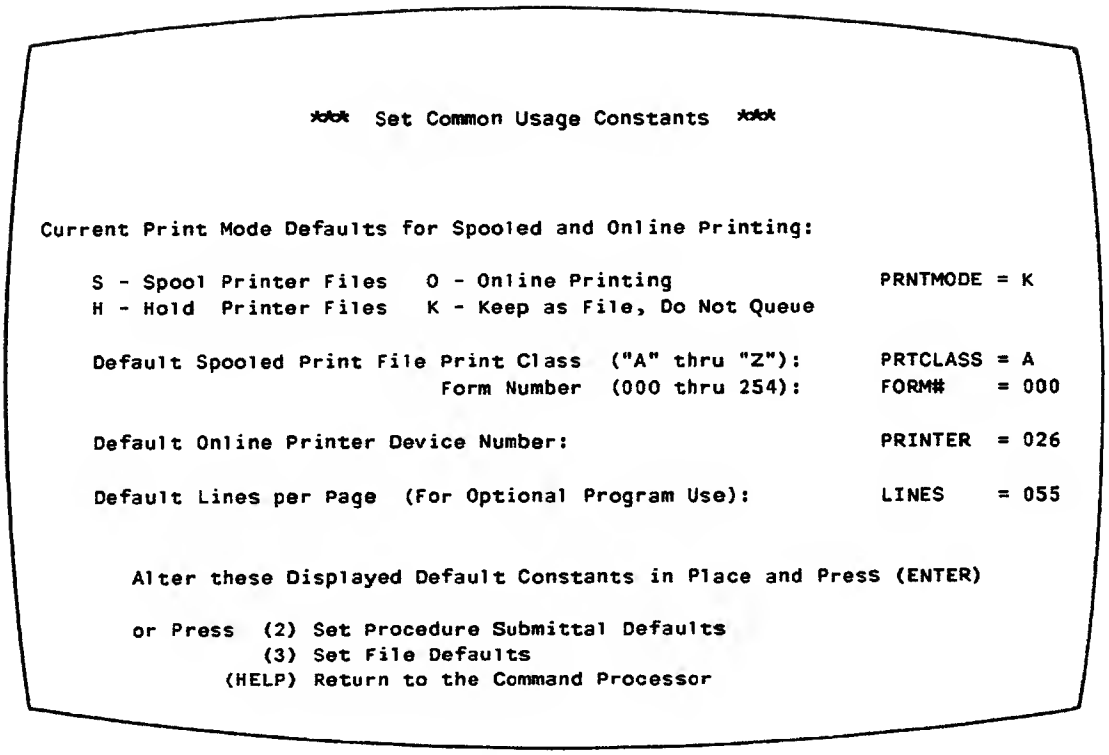


Figure 3-5. SET PRINT MODE DEFAULTS Screen Format

For further discussion of print spooling, manipulation of the print queue, and the Print Task, consult Section 1-8 "Printing Capabilities" in Chapter 1 of this manual, and the VS System Operation Guide.

Print Modes

The four print modes have differing characteristics which makes each one useful under specific circumstances.

Spool -- Use this mode to automatically print your file. The system stores the print output in a print file and places it in the user's print library. The system also creates an entry for that file on the print queue. When the file reaches the top of the queue and a printer becomes available, the system automatically prints it. Files move up the queue on a first-come, first-served basis, depending on their print file class. You can change this order from the print queue, but you can only move an entry downward (refer to Section 3.7.1 "Controlling the Print Queue"). Spool is the default mode which the system sets during Logon.

Hold -- Use this mode to defer printing your file. The system stores the print output in a print file and places it in the user's print library. The system also creates an entry for the file on the print queue. However, the system does not print the file until you release

it. You would generally use Hold to defer printing until you decide whether the output is of value. If you do not want the information from a print file, since the system is holding it on the queue, you can scratch it without printing it.

Keep -- Use this mode to store print files without placing entries on the print queue. The system stores the print output in a print file and places it in the user's print library. However, the system does not create a print entry for the file. Therefore, you cannot release keep files for printing from the print queue screen. Keep is useful when you do not need printed output from a program; for example, during program testing. You can simply scratch keep files without interfering with the print queue.

On-line -- The system writes on-line print files directly to the printer specified with this command, and prints them immediately if:

1. The designated printer is available for on-line printing (i.e., is not allocated for spooled printing) and

2. Another program is not using that printer.

The system never stores on-line print files on disk or enters them on the print queue. The use of on-line print mode is discouraged for the following reasons:

- It is inefficient and time-consuming because the files are sent to their printer(s) line by line as they are created.

- It is restrictive to the user since, because the files are printed directly, you cannot intervene or select specific material to print.

- Because on-line print files are not stored, permanent loss of some or all of the file can result if any interruption occurs in the movement of information to the printer.

The bottom of the SET PRINT DEFAULTS screen contains a list of command options that allow you to set procedure submittal defaults (PF2), return to the FILE DEFAULTS screen (PF3), or return to the Command Processor menu (HELP)

3.4.3 Procedure Submittal Defaults

If you press PF2 from the SET FILE DEFAULTS screen, the system displays the SET PROCEDURE SUBMITTAL DEFAULTS screen. This screen allows you to specify default values for the job submittal status, job scheduling class, and job execution time limit for background job processing. Then, the system displays the defaults that you specify on the SUBMIT PROCEDURE command screen. (Section 3.13 contains a description of SUBMIT PROCEDURE.)

Figure 3-6 contains a sample SET PROCEDURE SUBMITTAL DEFAULTS screen, and the following list explains the parameters:

JOBQUEUE — The default job submittal status determines whether the system automatically executes the job or holds it in the queue until you release it. There are two options:

- R Run — The system runs the job automatically.
- H Hold — Assigns the designated job to the job queue; the operator may release it, change it, or cancel it.

JOBCLASS — This parameter is the default job scheduling class (A - Z) to which jobs are assigned.

JOBLIMIT — This parameter is the default job execution time limit, the most time the central processor may spend on a specific job. Specify the parameter in hours, minutes, and seconds. Zero or blank indicates no limit. The system uses this parameter in conjunction with the CPU LIMIT parameter of the SUBMIT PROCEDURE command.

```
                    *** Set Common Usage Constants ***


Current Defaults for Procedure Submittal via the Command Processor
"RUN" and "SUBMIT" Commands:

    Default Submittal Status:
          R - Run,  Proc Eligible for Scheduling
          H - Hold, Do Not Run Proc Until Released
                    by Submitter or Operator              JOBQUEUE = R

    Default Proc Scheduling Class  ("A" thru "Z"):        JOBCLASS = A

    Default Proc Execution Time Limit:
        Central Processor Time in Format HH:MM:SS
        - No Value (or Zero) Indicates "No Limit"      JOBLIMIT = 00 : 00 : 00


       Alter These Displayed Default Constants in Place and Press (ENTER)

       or Press  (1) Set Print Mode Defaults
                 (3) Set File Defaults
              (HELP) Return to the Command Processor
```

Figure 3-6. SET PROCEDURE SUBMITTAL DEFAULTS Screen Format

For additional information about background jobs, consult Sections 3.13 "SUBMIT JOB" and 1.11 "BACKGROUND PROCESSING."

The bottom of the SET PROCEDURE SUBMITTAL DEFAULTS screen contains a list of command options that allow you to set the print mode defaults (PF1), return to the FILE DEFAULTS display (PF3), or return to the Command Processor menu (HELP).

3.5 SHOW PROGRAM COMPLETION REPORT

SHOW PROGRAM COMPLETION REPORT is associated with PF3 on the Main Command Processor menu. This command is intended for the systems programmer/analyst and displays the following information about the program or procedure which was just completed:

- Name of the program
- Total elapsed time in hours, minutes, and seconds
- Total CPU time in hours, minutes, and seconds
- Total I/O operations performed for each workstation, printer (when the print mode is on-line), tape, and nonpaging disk
- Total page-ins and page-outs required by both the system and program

This command also displays the Segment 2 size for the workstation that issued this command. Segment 2 is the portion of main memory containing the static, or modifiable, portion of a program. The maximum Segment 2 space for each workstation is specified at system generation.

Figure 3-7 is a sample PROGRAM COMPLETION REPORT screen. The information on this screen is useful in assessing a program's total resource requirements and the efficiency with which that program is utilizing the virtual memory, given the current resource requirements of all other running programs, users, and I/O operations. The number of page-ins and page-outs refers to the number of times that virtual memory (a memory allocation technique) moves page segments of both system and user programs into and out of main memory.

```
                    *** Show Program Completion Report ***

Workstation  20  Ready                 9:47 am        Thursday    February 5, 1981

                      Program EDITOR   Processing Completed



Total Elapsed Time =  00:00:13 (HMS)   Program Processor Time =  00:00:00 (HMS)

          Total Workstation I/O          =      0 Operations
          Total Printer I/O              =      0 Operations
          Total Tape I/O                 =      0 Operations
          Total Non-Paging Disk I/O      =      4 Operations
          Total Page-Ins      =     25 (System)   =      0 (Program)
          Total Page-Outs     =      6 (System)   =      0 (Program)

          Segment 2 Address Space        =    256 K



                      (HELP) Return to the Command Processor
```

Figure 3-7. Sample PROGRAM COMPLETION REPORT Screen

3.6 SHOW PROGRAM STATUS

The SHOW PROGRAM STATUS is associated with PF3 on the Modified Command Processor menu. This command is intended for the systems programmer/analyst and displays the following information about the interrupted program or procedure:

- Name, library, and volume of the interrupted program
- Name of active subprogram (if applicable)
- Total elapsed time in hours, minutes, and seconds
- Total CPU time before interruption in hours, minutes, and seconds
- Total I/O operations performed for each workstation, printer (when print mode is on-line), tape, and nonpaging disk
- Total page-ins and page-outs used by both the system and the program before interruption

This command also displays the Segment 2 size and the remaining Segment 2 space for the workstation that issued the command (in bytes). Segment 2 is the portion of main memory containing the static, or modifiable, portion of a program. The maximum Segment 2 space for each workstation is specified at system generation.

Figure 3-8 is a sample PROGRAM STATUS screen. The information on this screen is useful in assessing the current status of an interrupted program and the efficiency with which that program is utilizing virtual memory, given the current resource requirements of all other running programs, users, and I/O operations. The number of page-ins and page-outs refers to the number of times that virtual memory (a memory allocation technique) moves page segments of both system and user programs into and out of main memory.

Two subcommands, which provide additional information concerning the interrupted program, are available from this screen: SHOW FILES AND DEVICES IN USE (PF1) and SHOW BUFFER POOLING STATISTICS (PF2).

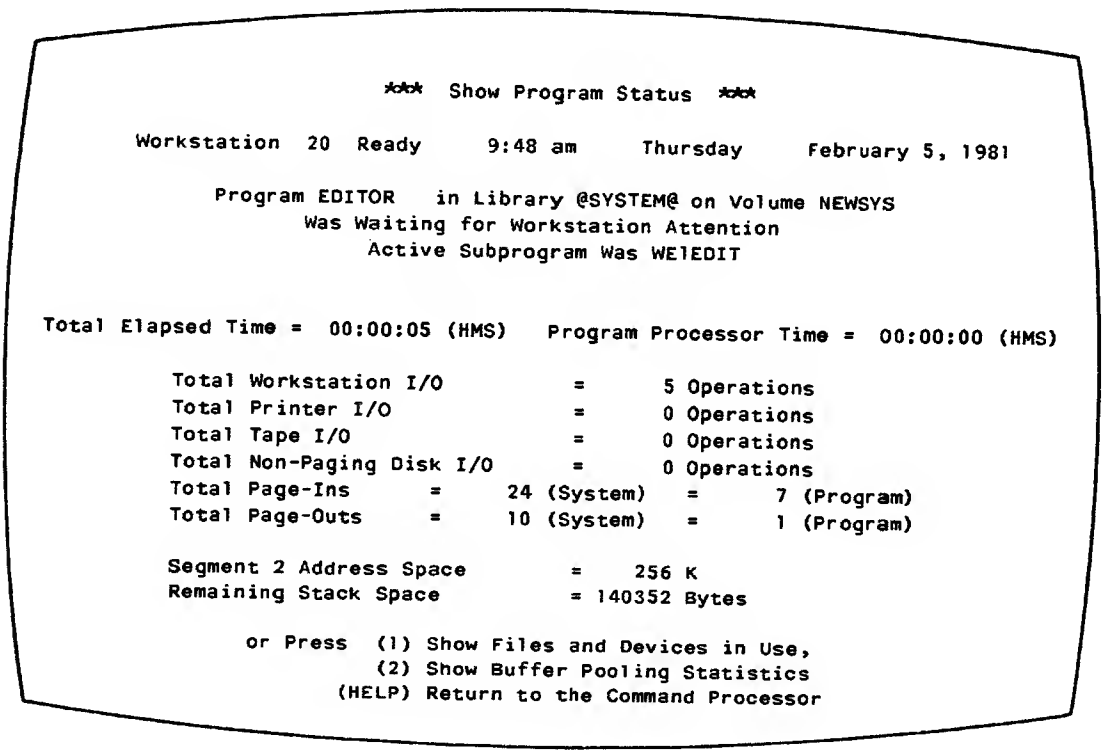


Figure 3-8. Sample PROGRAM STATUS Screen

SHOW FILES AND DEVICES IN USE displays a table containing information about all the files and devices that the interrupted program is currently using. This table includes the name, library, volume, device(s), record number and record size, file type, and open status (i.e., extension, update) of each device for each open file.

SHOW BUFFER POOLING STATISTICS displays a table containing the buffer pooling statistics for the interrupted program, if the program is using buffer pooling. This information includes the number of buffer pools currently in

use and the following statistics for the first buffer pool: number of files using the pool, number of 2K buffers in the pool, buffer hit count, and buffer miss count. (Refer to the VS Operating System Services manual for more information on buffer pooling.)

3.7 MANAGE PRINT/PROCEDURE QUEUES

MANAGE PRINT/PROCEDURE QUEUES is associated with PF4 on both Command Processor menus. This command displays and controls the print and procedure queues. When you press PF4, the system displays a 2-entry menu that allows you to access the print queue (PF2) or the procedure queue (PF3). The combined entries on these two queues can total 1,920.

3.7.1 Controlling the Print Queue

To examine and manipulate the print queue, press PF2 from the MANAGE PRINT/PROCEDURE QUEUES menu. The system then displays the print queue screen, illustrated in Figure 3-9. This screen provides a list of the print queue entries, a statement of the total entries in the queue, and the following information for each file in the queue:

- Entry's position in the print queue
- File, library, and volume names
- File originator
- Print class (A - Z)
- Print form number
- Number of copies to print (1 - 32767)
- Number of lines
- Post-printing disposition (blank, save, or requeue)
- Status (blank, hold, or printing)

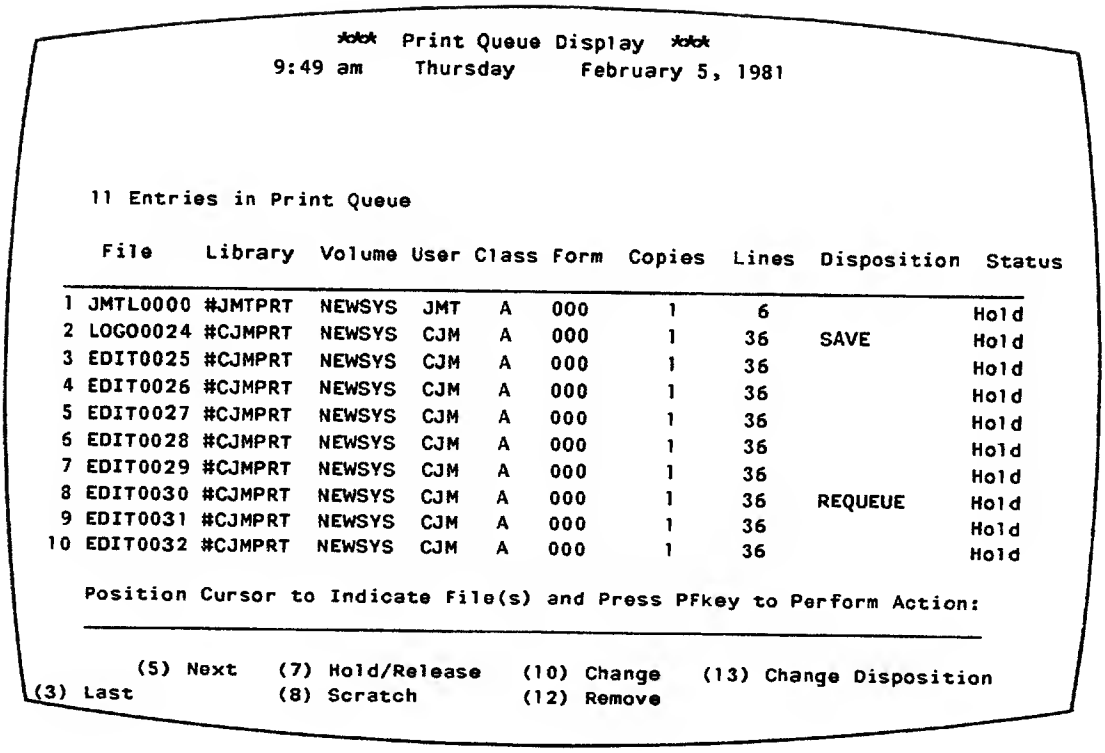


Figure 3-9. Sample Print Queue Screen

The disposition determines how the system will handle a print file after printing: scratch the file (blank), save the file but remove its entry from the queue (save), or save the file and retain its entry on the queue (requeue). The status indicates whether the file will print automatically when a printer is available (blank), will remain on the queue until you release it for printing (hold), or is currently printing (printing).

The bottom of the print queue screen contains a menu of commands that you can use to manipulate the print queue entries identified by your User ID. You can change the entry's print class, form number, number of copies, and disposition; you can scratch the file, release it, hold it, or remove the entry from the queue and keep the file; and you can lower an entry's position in the queue, but you cannot raise it. To perform any of these functions, position the cursor next to the the file's entry and press one of the PF keys in the following list.

PF Key	Option	Action
2	FIRST	Displays the first screen of print queue entries.
3	LAST	Displays the last screen of print queue entries.
4	PREVIOUS	Displays the previous screen of print queue entries.
5	NEXT	Displays the next screen of print queue entries.
7	HOLD/RELEASE	Releases your file for printing, if it is on hold. In all other cases, PF7 changes the file's status to HOLD.
8	SCRATCH	Scratches the file and removes its entry from the print queue. You can scratch a file only if: . You have access rights . No unexpired retention period is specified . No other queue entries exist
10	CHANGE	Changes the file entry's position in the print queue; you can only lower the position within the file's print class. Also, changes the file's print class, print form number, and/or number of copies to print. You can change only your own print queue entries.
12	REMOVE	Removes the entry from the print queue, but does not scratch the file. (This effectively gives the file a Keep status.)
13	CHANGE DISPOSITION	Changes the print file entry's disposition. You can use this option only after the file is printed. The three possible choices follow: PF4 SAVE — Saves the print file but removes its entry from the print queue. PF5 REQUEUE — Saves the print file and places its entry at the end of the print queue. PF8 SCRATCH — Scratches the print file and removes its entry from the print queue. The Disposition column is left blank. Scratch print files are actually scratched only if the file has no unexpired retention period, the user has scratch access rights, and no other print queue entries exist for that print file.

3.7.2 Controlling the Procedure Queue

To examine and modify the procedure queue, press PF3 from the MANAGE PRINT/PROCEDURE QUEUES menu. The system then displays the procedure queue screen illustrated in Figure 3-10. This screen provides a list of the background jobs in the queue, as well as the following information for each job:

- Position in the queue
- Originator (user)
- Proc-ID (the name of the job specified, when that job was submitted)
- Procedure's name, library, and volume
- Job class
- CPU time limit
- Abnormal termination dump specification
- Post-execution queue entry disposition
- Status

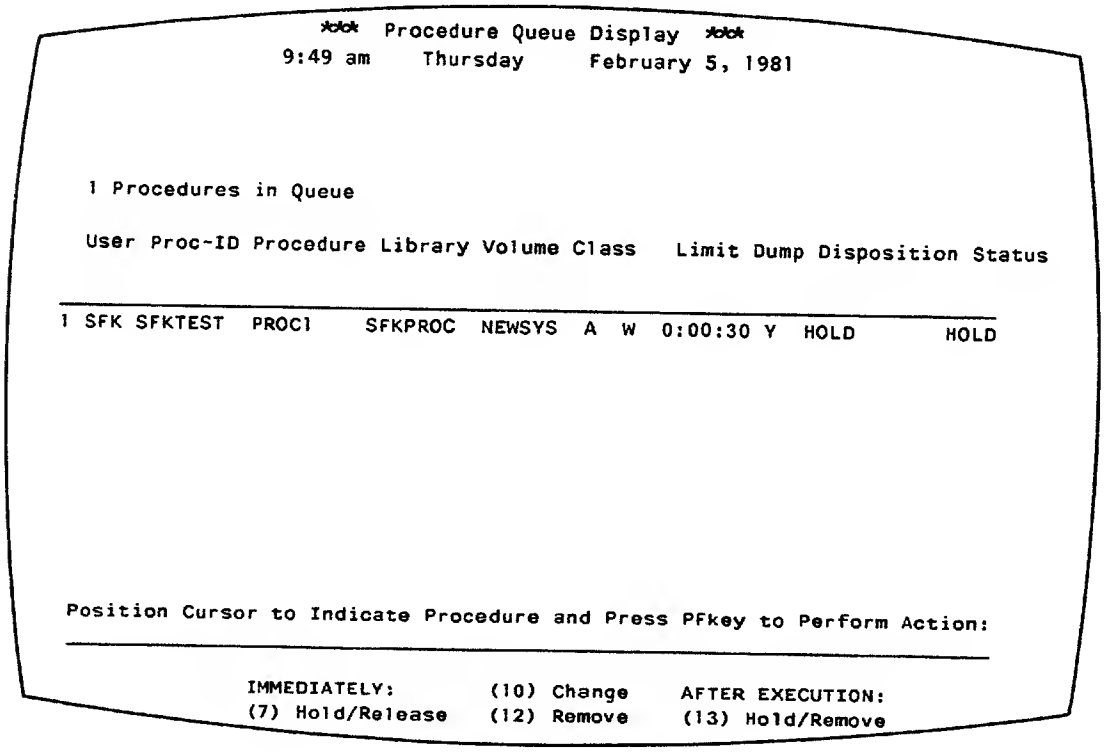


Figure 3-10. Sample Procedure Queue Screen

The system queues a background job by job class and by active/hold status. It executes the job according to the priority of its job class. Within a job class, jobs are executed on a first-in, first-out basis. (The operator can modify the job class priority list from the Operator's Console.)

The bottom of the procedure queue screen contains a menu of commands that you use to manipulate the procedure queue entries identified by your User ID. Options are available for both before and after execution of the job. To perform any of these functions, position the cursor next to the file's entry and press one of the following PF keys:

PF Key	Option	Action
2	FIRST	Displays the first screen of procedure queue entries.
3	LAST	Displays the last screen of procedure queue entries.
4	PREVIOUS	Displays the previous screen of procedure queue entries.
5	NEXT	Displays the next screen of procedure queue entries.
		Before Execution
7	HOLD/RELEASE	Releases your job for execution, if it is on hold. In all other cases, changes the status to HOLD.
10	CHANGE	Changes the job's position in the queue; you can only lower the position. Also, changes the job class, CPU time limit, and/or abnormal termination DUMP parameter.
12	REMOVE	Removes the job from the queue without executing it. Note that you cannot remove an executing job; executing jobs must be cancelled by an operator from the Operator's Console.
		After Execution
13	HOLD/REMOVE	Specifies the job's disposition as either Remove (blank) or Hold. Hold jobs are retained in the queue after executing and may be executed again; Remove jobs are deleted from the job queue after execution.

3.8 MANAGE FILES/LIBRARIES

The MANAGE FILES/LIBRARIES command is associated with PF5 on both Command Processor menus. This command allows you to inspect and modify the contents of on-line volumes. MANAGE FILES/LIBRARIES provides the following information:

- The names of all currently mounted volumes
- The names of all libraries on a mounted volume
- The number of files in all libraries on a volume
- The names of all files in a library
- The attributes of any file
- The free extents on any volume

You can access information about libraries and files through a system that presents library, file, and file attribute information on successive screens. To access a more detailed level of information, you merely position the cursor and key ENTER. For example, from the VOLUMES screen, if you wish to access information about the libraries on volume ZZZZZ, simply move the cursor next to the volume name, ZZZZZ, and press ENTER. The system then displays the LIBRARIES screen for volume ZZZZZ.

3.8.1 Volume Information

The first screen that MANAGE FILES/LIBRARIES provides is the VOLUMES display, illustrated in Figure 3-11. This screen provides a list of all currently mounted volumes. To examine information about the libraries on a particular volume, you can simply move the cursor to the volume name and press ENTER. You can also type the volume name next to VOLUME at the top of the screen and press ENTER. In either case, the system displays the LIBRARIES screen for that volume.

To access information about a particular file or library from this screen, you must type in values for VOLUME and LIBRARY (for a library) or VOLUME, LIBRARY, and FILE (for a file). The system then displays the appropriate screen.

If you used the SET USAGE CONSTANTS command to provide default names for INVOL and INLIB, these values appear for VOLUME and LIBRARY, respectively.

This screen also makes two submenu options available. You can examine the first 20 free extents on a volume by tabbing the cursor to the desired volume in the list and keying PF12 (see Subsection 3.8.5, "Free Extents on a Volume"). You can also print the command screen by keying PF15 (see Subsection 3.8.6, "Print Screen").

```
                    *** Manage Files/Libraries ***

Use Direct Entry To Manage a Particular File or Library:

      VOLUME = NEWSYS  LIBRARY = CJMOBJ  FILENAME = ********

Or Select a Volume from the List of Currently Mounted Volumes
       by Positioning the Cursor at the associated Tabstop:


* NEWSYS
* TC1VOL
* VOL555
* ZENITH




Then Select:          (ENTER) To Display Libraries on the Volume
                        (12)  Free Extents on the Volume
                        (15)  Print Screen
                       (HELP) Return to Command Menu
```

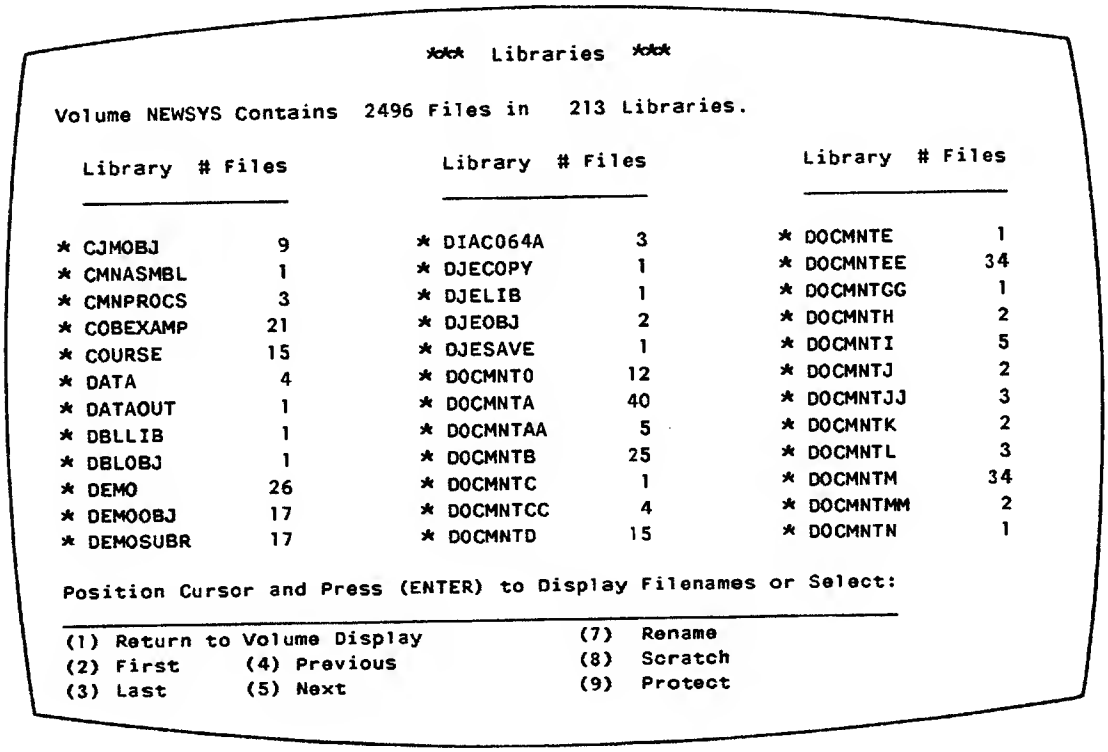
Figure 3-11. Sample VOLUMES Information Screen

3.8.2 Library Information

There are two ways to access library information from the VOLUMES display, as explained above. After keying ENTER, the first LIBRARIES screen, illustrated in Figure 3-12, appears. This screen provides the following information:

- The number of libraries and files located on the designated volume
- An alphabetical list of all libraries resident on that volume
- The number of files located in each library

If you type the name of a library, as well as that of a volume in the VOLUMES display, the first library displayed on the list will be the library you specified. Similarly, you can enter a partial library name, and the first name displayed will be the library that alphabetically follows that partial name.



```
                         *** Libraries ***

Volume NEWSYS Contains  2496 Files in   213 Libraries.

  Library  # Files          Library  # Files          Library  # Files

* CJMOBJ        9        * DIAC064A      3        * DOCMNTE       1
* CMNASMBL      1        * DJECOPY       1        * DOCMNTEE     34
* CMNPROCS      3        * DJELIB        1        * DOCMNTGG      1
* COBEXAMP     21        * DJEOBJ        2        * DOCMNTH       2
* COURSE       15        * DJESAVE       1        * DOCMNTI       5
* DATA          4        * DOCMNT0      12        * DOCMNTJ       2
* DATAOUT       1        * DOCMNTA      40        * DOCMNTJJ      3
* DBLLIB        1        * DOCMNTAA      5        * DOCMNTK       2
* DBLOBJ        1        * DOCMNTB      25        * DOCMNTL       3
* DEMO         26        * DOCMNTC       1        * DOCMNTM      34
* DEMOOBJ      17        * DOCMNTCC      4        * DOCMNTMM      2
* DEMOSUBR     17        * DOCMNTD      15        * DOCMNTN       1

Position Cursor and Press (ENTER) to Display Filenames or Select:

(1) Return to Volume Display          (7)  Rename
(2) First      (4) Previous           (8)  Scratch
(3) Last       (5) Next               (9)  Protect
```

Figure 3-12. Sample LIBRARIES Screen

Several options are available from the LIBRARIES level; they display the pages of the library list and perform certain functions on the libraries in that list. To perform an operation on a specific library, position the cursor in the pseudoblank next to the desired library's name, and press the appropriate PF key. The following list contains all the commands available from the LIBRARIES screen:

PF Key	Option	Action
ENTER	DISPLAY FILENAMES	Displays the names of the files contained in the specified library.
1	RETURN TO VOLUME DISPLAY	Returns to the VOLUMES display (original screen).
2	FIRST	Displays the first screen of libraries on the volume.
3	LAST	Displays the last screen of libraries on the volume.
4	PREVIOUS	Displays the previous screen of libraries on the volume.
5	NEXT	Displays the next screen of libraries on the volume.
7	RENAME	Renames the designated library.
8	SCRATCH	Scratches the designated library.
9	PROTECT	Allows you to modify the PROTECTION CLASS (PF2), OWNER OF RECORD (PF3), and EXPIRATION DATE (PF4) of the designated library.
15	PRINT SCREEN	Copies the current screen to a printed file.

3.8.3 File Information

There are two ways to access file information. On the LIBRARIES display, position the cursor next to the library whose file information you wish to examine and key ENTER. The second method is: on the VOLUMES display, specify a name for FILE as well as for VOLUME and LIBRARY. Both methods access the FILENAMES screen, illustrated in Figure 3-13. The FILENAMES screen displays the number of files assigned to the designated library and an alphabetical listing of all files in that library.

If you specified a file name in the VOLUMES display to reach this screen, the file you specified is the first file displayed. Also, if you enter a partial file name, the first name displayed will be the file that alphabetically follows that partial name.

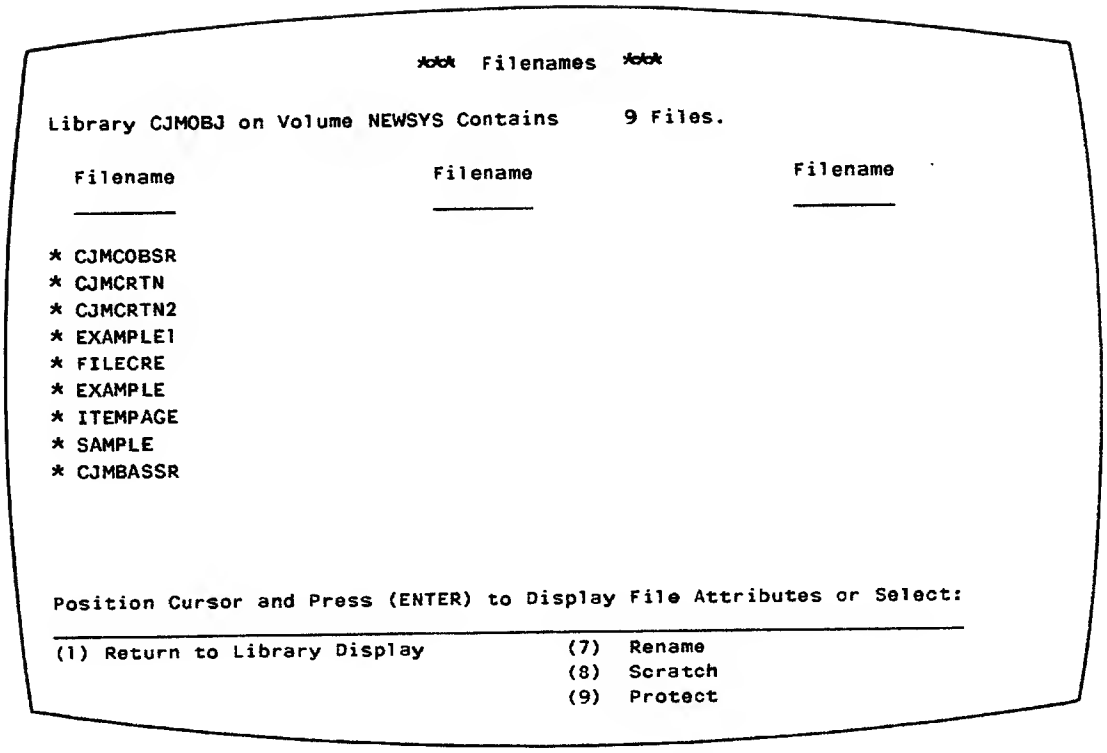


Figure 3-13. Sample FILENAMES Screen

Several options are available from the FILENAMES level; they display the pages of the file name list and perform certain functions on the files in that list. To perform an operation on a specific file, position the cursor in the pseudoblank next to the desired file's name, and press the appropriate PF key. The following list contains all the commands available from the FILENAMES Screen:

PF Key	Option	Action
ENTER	DISPLAY FILE ATTRIBUTES	Displays the attributes of the specified file.
1	RETURN TO LIBRARY DISPLAY	Returns to the LIBRARIES display.
2	FIRST	Displays the first screen of file names in the library.
3	LAST	Displays the last screen of file names in the library.
4	PREVIOUS	Displays the previous screen of file names in the library.

PF Key	Option	Action
5	NEXT	Displays the next screen of file names in the library.
7	RENAME	Renames the designated file.
8	SCRATCH	Scratches the designated file.
9	PROTECT	Permits you to modify the PROTECTION CLASS (PF2), OWNER OF RECORD (PF3), and EXPIRATION DATE (PF4) of the designated file.
10	PRINT	Prints the designated file if it is a print file; displays a screen through which you can specify the print mode, print class, scratch option, number of copies, and form number to use when printing.
15	PRINT SCREEN	Copies the current screen to a print file.

3.8.4 File Attribute Information

To access file attributes information from the FILENAMES screen, position the cursor next to the name of the desired file and key ENTER. The system displays the FILE ATTRIBUTES screen, illustrated in Figure 3-14; it provides the following information about the designated file:

- Name, library, and volume
- Organization -- indexed or consecutive
- Record length -- variable or fixed
- Record compression option
- Date created
- Date last modified
- Expiration date
- Protection class
- Characteristics
  - Number of records
  - Record length (bytes)
  - Number of extents allocated
  - Number of blocks used
  - Number of blocks allocated

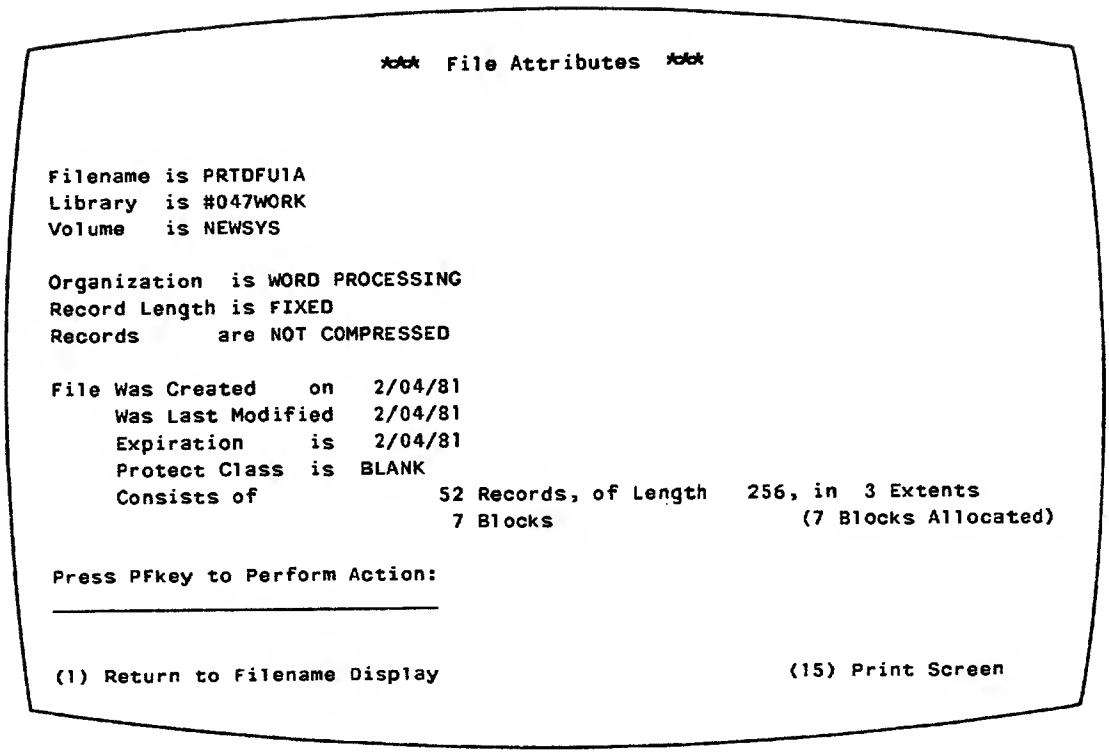


Figure 3-14. Sample FILE ATTRIBUTES Screen

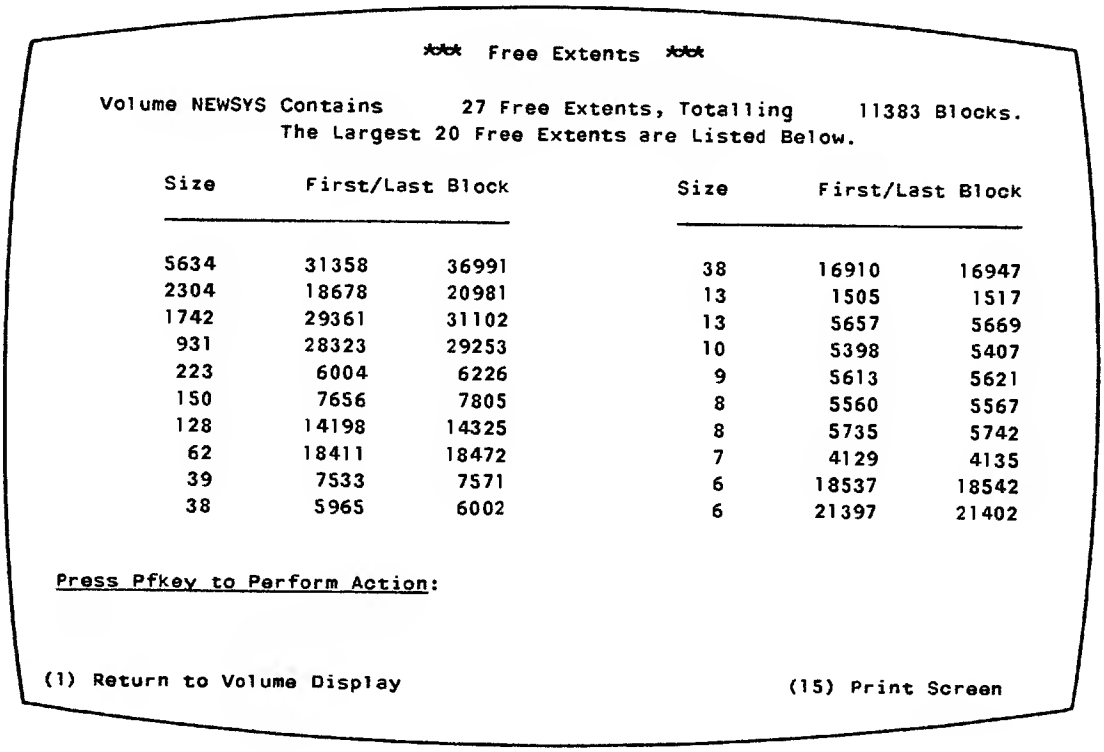
There are three options available to the user from the FILE ATTRIBUTES display:

PF Key	Option	Action
1	RETURN TO FILENAME DISPLAY	Returns to the FILENAMES display.
10	PRINT	Prints the designated file if it is a print file; displays a screen through which you can specify the print mode, print class, scratch option, number of copies, and form number to use when printing.
15	PRINT SCREEN	Copies the currently displayed screen to a print file.

3.8.5 Free Extents on a Volume

You access the FREE EXTENTS ON THE VOLUME subcommand from the VOLUMES display by positioning the cursor in the pseudoblank next to the name of the desired volume and pressing PF12. The FREE EXTENTS screen, illustrated in Figure 3-15, displays the total number of free extents and the total number of blocks available in the free extents, as well as a table of the 20 largest

free extents on the volume. This table shows the total size of each extent and the disk addresses of the first and last blocks of each free extent. From the FREE EXTENTS screen, you can either return to the VOLUMES display (PF1) or print the screen (PF15).



*** Free Extents ***

Volume NEWSYS Contains 27 Free Extents, Totalling 11383 Blocks.
The Largest 20 Free Extents are Listed Below.

Size	First/Last Block		Size	First/Last Block	
5634	31358	36991	38	16910	16947
2304	18678	20981	13	1505	1517
1742	29361	31102	13	5657	5669
931	28323	29253	10	5398	5407
223	6004	6226	9	5613	5621
150	7656	7805	8	5560	5567
128	14198	14325	8	5735	5742
62	18411	18472	7	4129	4135
39	7533	7571	6	18537	18542
38	5965	6002	6	21397	21402

Press Pfkey to Perform Action:

(1) Return to Volume Display (15) Print Screen

Figure 3-15. Sample FREE EXTENTS Screen

3.8.6 Print Screen

If you press PF15 from any of the previously mentioned command screens, you access the Print Screen command. This command creates a print file from the current screen. (It is available for all screens accessible from the Command Processor.)

3.9 MANAGE DEVICES

MANAGE DEVICES allows you to view the current information about the status of all the peripheral devices on the system. It also permits you to mount and dismount disks and tapes and to perform other device management functions. Additional information about device management is available in the VS System Operation Guide.

When you press PF6 from the Main or Modified Command Processor menu, the MANAGE DEVICES menu, illustrated in Figure 3-16, appears. From this screen, you press the appropriate PF key to display information about a specific device type. The PF key for a particular device type does not appear unless that type of device is actually present on the system.

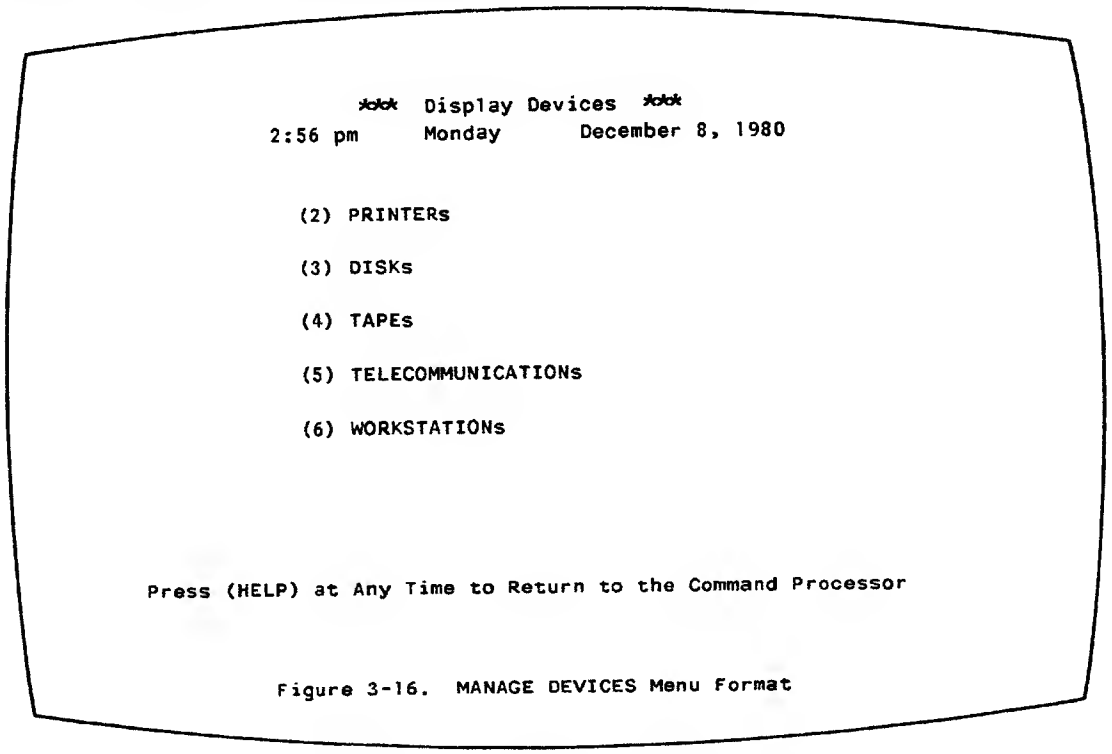


Figure 3-16. MANAGE DEVICES Menu

The user can reach the MANAGE DEVICES menu from any device screen by pressing PF1. To move from one device screen to another (for example, from the DISKS menu to the TAPES menu), you must return to the MANAGE DEVICES menu, then proceed to the next device screen from there.

3.9.1 Managing Printers

To reach the PRINTERS screen, press PF2 from the MANAGE DEVICES menu. The PRINTERS screen provides information about all local printers configured for the system and all remote printers which are currently connected. The information is listed in the order of the unit number (device address). The following information is provided for all printers:

- Unit number (device address)
- Device model number
- Currently mounted form number
- Printer type -- matrix, band, chain, image, daisy, typesetter
- Status -- detached, idle, released, waiting, printing

If a printer is released, its owner's User ID and/or job name appear. If the printer is printing, the submitter's file name, library, volume, and User ID are displayed. If there is a problem with the printer (for example, forms not mounted), the Status field blinks.

Figure 3-17 is a sample PRINTERS screen. Note that the bottom of the screen lists a Display Scheduling command. This command displays a list of scheduling information; this information is described in the VS System Operation Guide. To access the scheduling information for a specific printer, position the cursor next to that printer's entry, and press PF7.

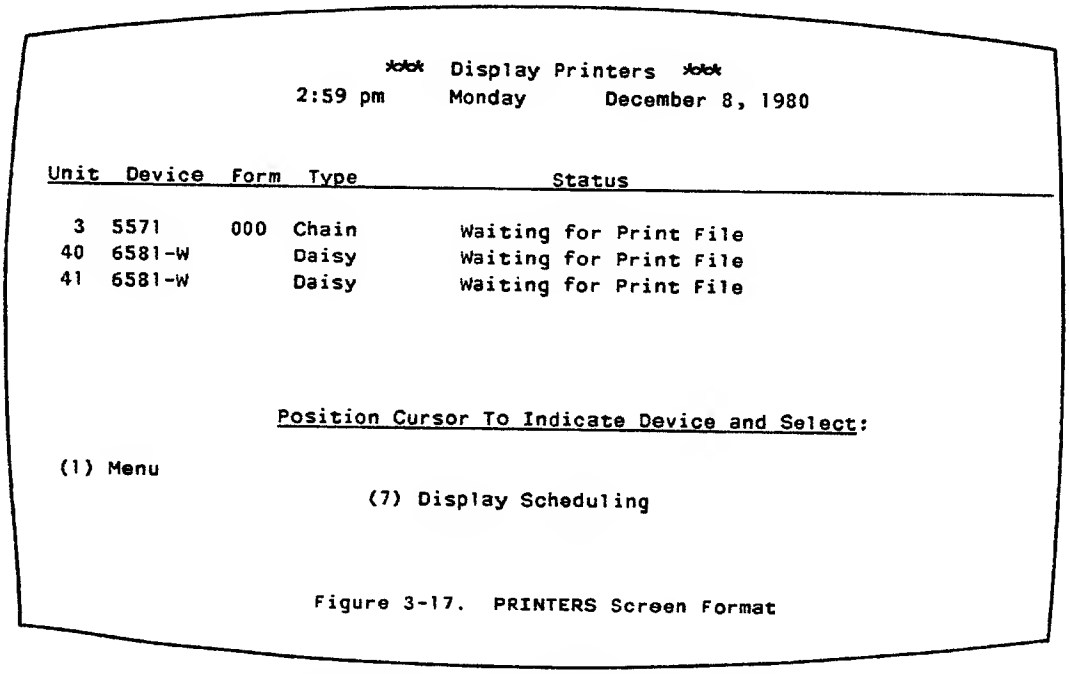


Figure 3-17. PRINTERS Screen Format

3.9.2 Managing Disks

To reach the DISKS screen, press PF3 from the MANAGE DEVICES menu. The DISKS screen provides information about all the disk units configured for the system. The information is listed in the order of the unit number (device address). The following information is provided for all disk devices:

- Unit number
- Device model number
- Capacity in megabytes or kilobytes
- Platter type -- removable, fixed, or diskette

If a volume is mounted on the unit, the following additional information appears:

- Volume name
- Restrictions -- restricted removal, protected use, or exclusive use
- Number of open files
- Any status other than Ready

Figure 3-18 is a sample DISKS screen. Note that the bottom of the screen contains a list of the commands available to control disks and the PF keys associated with them. These commands are described below.

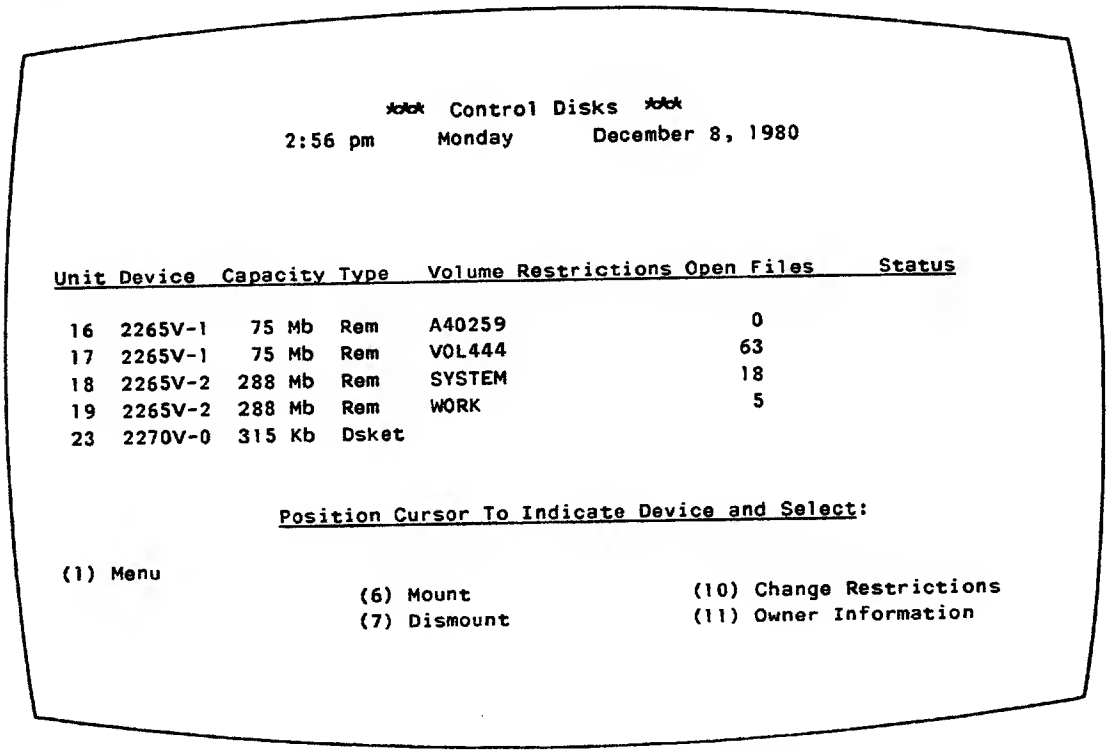


Figure 3-18. DISKS Screen Format

Mount

To logically mount a volume on a disk unit, move the cursor to the line describing the unit, and press PF6. Fixed/removable disk combinations are described on two lines; move the cursor to either line of the description.

Next, the Mount Disk screen, illustrated in Figure 3-19, appears. Supply the following parameters:

VOLUME — Volume name; if you specify a name that does not correspond to the name on the volume's label, the system logically mounts the tape with the name on the label and sends you an appropriate message.

LABEL — One of the following label types:

NL Nonlabeled
SL Standard disk label

If a disk volume was not initialized with a standard disk label (SL), the disk volume is regarded as nonlabelled and you should specify it as NL. Also, note that all uninitialized disk volumes must be mounted with the DISKINIT utility.

MODE

Choose one of the following modes:

SH	Shared Use	Any user can read from, write to, or dismount a shared volume.
RR	Restricted Removal	Only a user at the workstation from which the volume was mounted may dismount it; all other users may read from or write to the volume.
PR	Protected Use	All users may read from this volume, but only the user who mounted it may write to it or dismount it.
EX	Exclusive Use	Only the user at the workstation from which the volume was mounted may access it; no other users may perform any functions on it.

Allow Work Files?

Indicate whether the volume can be used for work libraries; choose YES or NO; the default is NO.

Allow Spool Files?

Indicate whether the volume can be used for spool libraries; choose YES or NO; the default is NO.

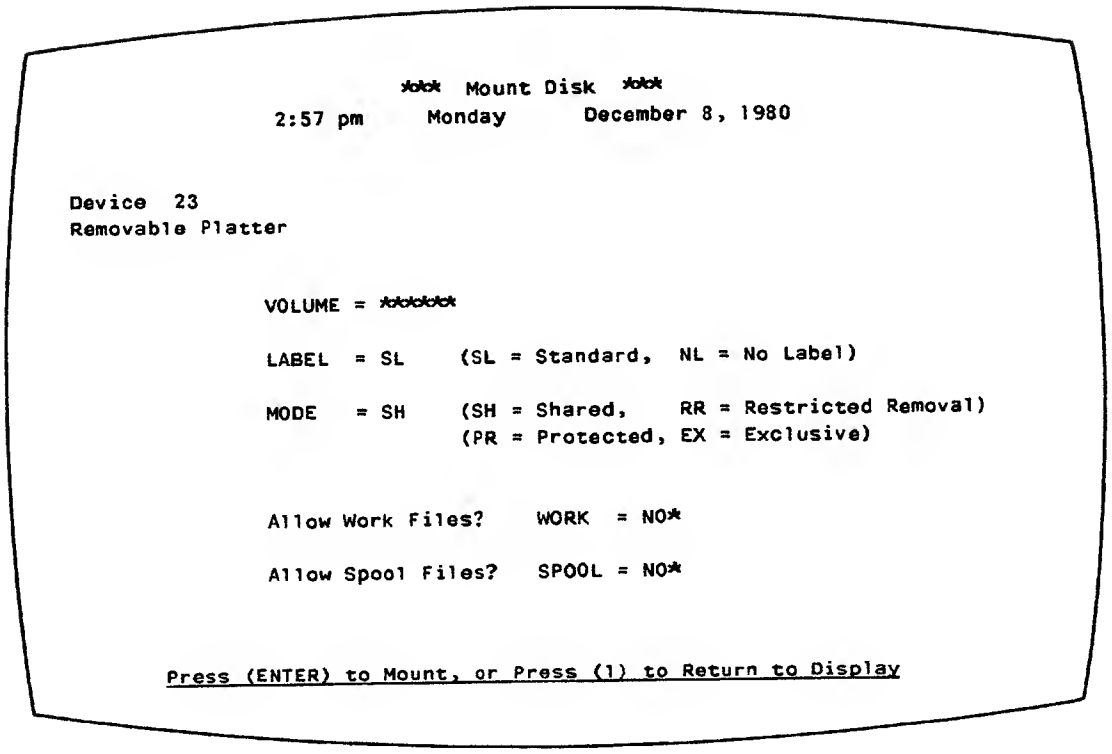


Figure 3-19. Mount Disk Screen Format

Press ENTER to initiate a logical mount; the system will prompt you to physically mount the disk. To cancel the mount and return to the DISKS screen, press PF1.

If a volume is already mounted in the specified disk unit, the system instructs you to remove that volume prior to mounting the new one unless one of the following conditions exists:

1. The volume's MODE is EX, PR, or RR; a volume mounted with one of these MODES may only be dismounted from the workstation at which it was mounted.

2. The volume is "in use." A volume is in use if one or more of its files are currently open. A volume cannot be dismounted until all its files are closed.

Dismount

To logically dismount a volume, move the cursor to the line that describes the volume, and press PF7. The volume name will blink so you can verify that this is the volume you wish to dismount. Then, press ENTER to initiate a logical dismount; the system will prompt you to physically dismount the volume. To cancel the dismount and return the screen to its normal state, press PF1.

You can dismount a volume only if you have the access rights to do so. Also, you cannot dismount a volume if one or more of its files are in use.

A dismount is not allowed for Models 2260V or 2280V Fixed/Removable Disk Units, because neither drive will function without a removable cartridge. You can dismount a cartridge only by mounting another cartridge via MOUNT.

Change Restrictions

This command modifies the mount restrictions. To change these restrictions for a specific volume, move the cursor to the line that describes that volume, and press PF10. The system highlights the Restrictions column and lets you type over the entry. Type one of the following restrictions:

- Shared
- Removal (restricted removal)
- Protected
- Exclusive

These choices are listed at the bottom of the screen. The command accepts any unique, leading substring, and a blank restriction is equivalent to Shared.

Press ENTER to effect the change, or press PF1 to cancel the command and return the screen to its original state.

Owner Information

To receive information about the volume owners, press PF11. A volume owner is the user who mounted the volume.

Owner Information displays the following data in the right-hand columns of the display screen, as illustrated in Figure 3-20:

- Owner's User ID and/or the name of the submitted job which has mounted the volume; this is supplied unless the volume is mounted for initialization or is a No Label (NL) volume.

- Volume's eligibility for work file and/or spool file allocations.

The Owner Information screen also makes two additional commands available. A description of these commands, Change and Status Information, follows.

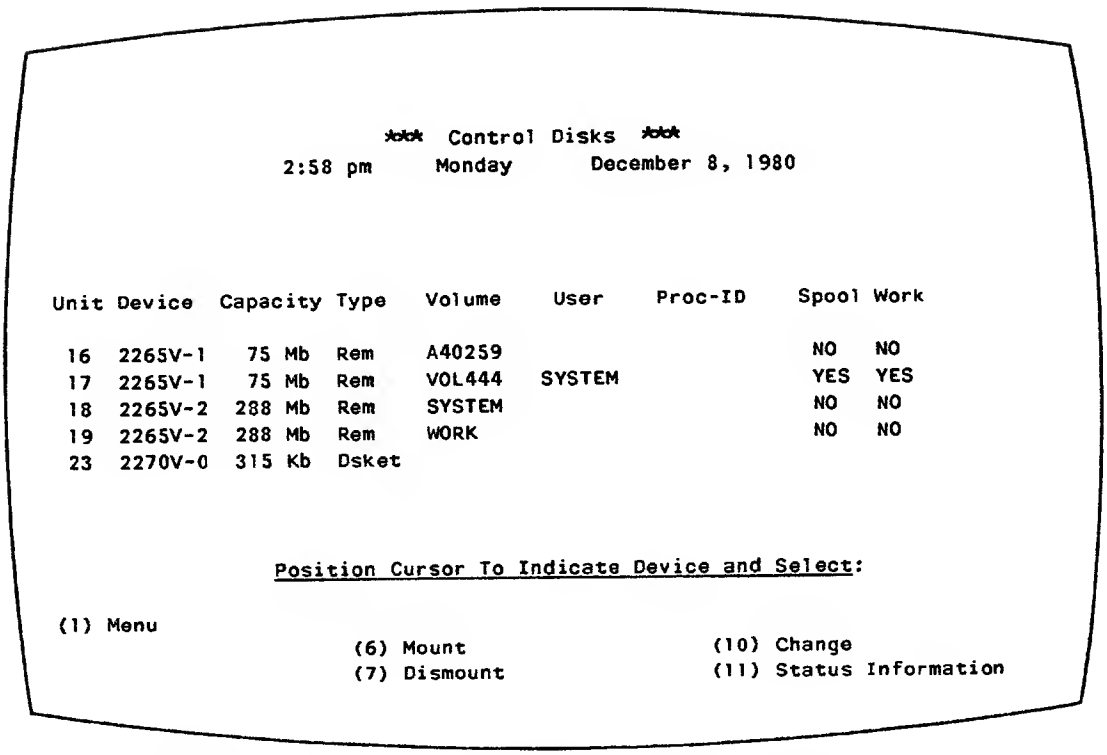


Figure 3-20. Owner Information Screen Format -- Disk

Change

This command modifies work and spool file eligibility. To change these restrictions for a specific volume, position the cursor next to that volume's entry and press PF10. The system highlights the Work and Spool columns and lets you change the entries. Type YES or NO in the column you wish to change. Then, press ENTER to effect the change, or press PF1 to cancel the command and return the screen to its original state.

Status Information

Owner data replaces the mount restrictions, number of open files, and status information that appears on the DISKS screen. To return to the DISKS screen, and that information, press PF11 from the Owner Information screen.

3.9.3 Managing Tapes

To reach the TAPES screen, press PF4 from the MANAGE DEVICES menu. The TAPES screen provides information about all the tape units configured for the system. The information is listed in the order of the unit number (device address). The following information is provided for all tape devices:

- Unit number (device address)
- Device model number
- Device type -- 9-track or 7-track dual (DD) or single density

If a volume is mounted on the unit, this additional information appears:

- Volume name
- Tape label -- AL = ANSI Label, NL = No Label, IL = IBM Label
- Tape density
- Any status other than Ready

Figure 3-21 is a sample TAPES screen. Note that the bottom of the screen contains a list of the commands available to control tapes and the PF keys associated with them. These commands are described below.

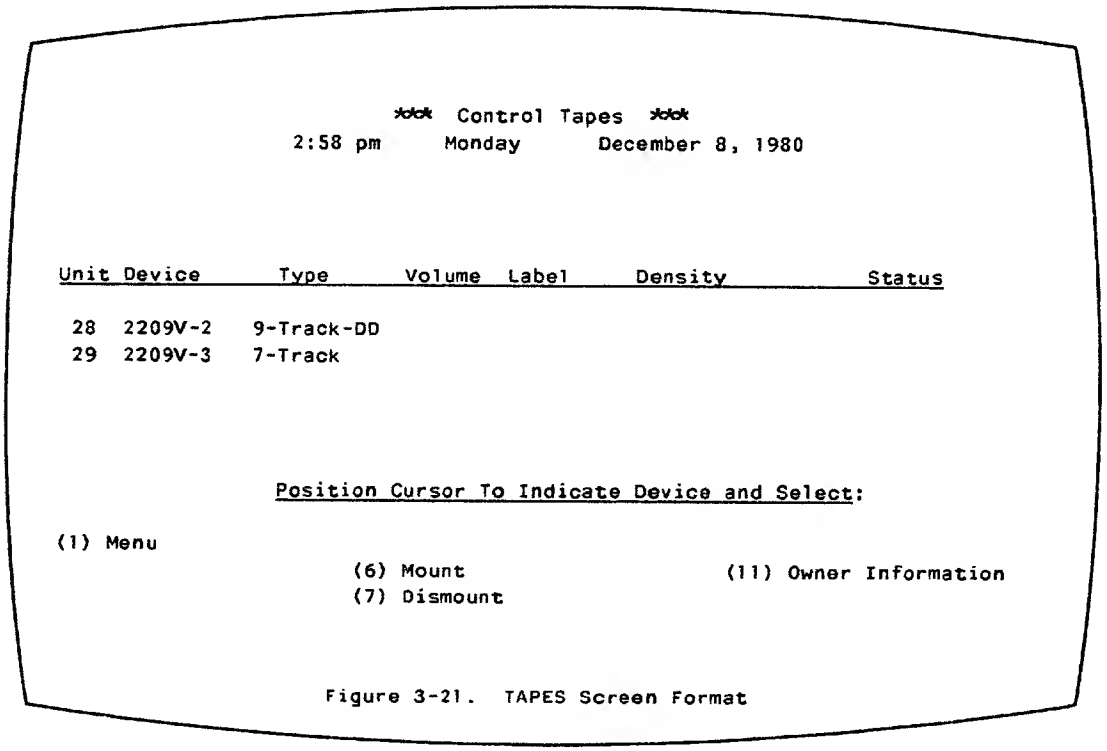


Figure 3-21. TAPES Screen Format

Mount

To logically mount a volume on a tape unit, move the cursor to the line describing the unit, and press PF6. The Mount Tape screen, illustrated in Figure 3-22, appears. Supply the following parameters:

VOLUME — Volume name; if you specify a name that does not correspond to the name on the volume's label, the system logically mounts the tape using the name on the label and sends you an appropriate message.

LABEL — One of the following label types:

AL ANSI tape label
NL Nonlabeled
IL IBM tape label

MODE Choose one of the following modes:

SH	Shared Use	Any user can read from, write to, or dismount a shared volume.
EX	Exclusive Use	Only the user at the workstation from which the volume was mounted may access it; no other users may perform any functions on it.

The system automatically changes a tape volume mounted for shared use to exclusive use when the first user attempts to open a file on the tape.

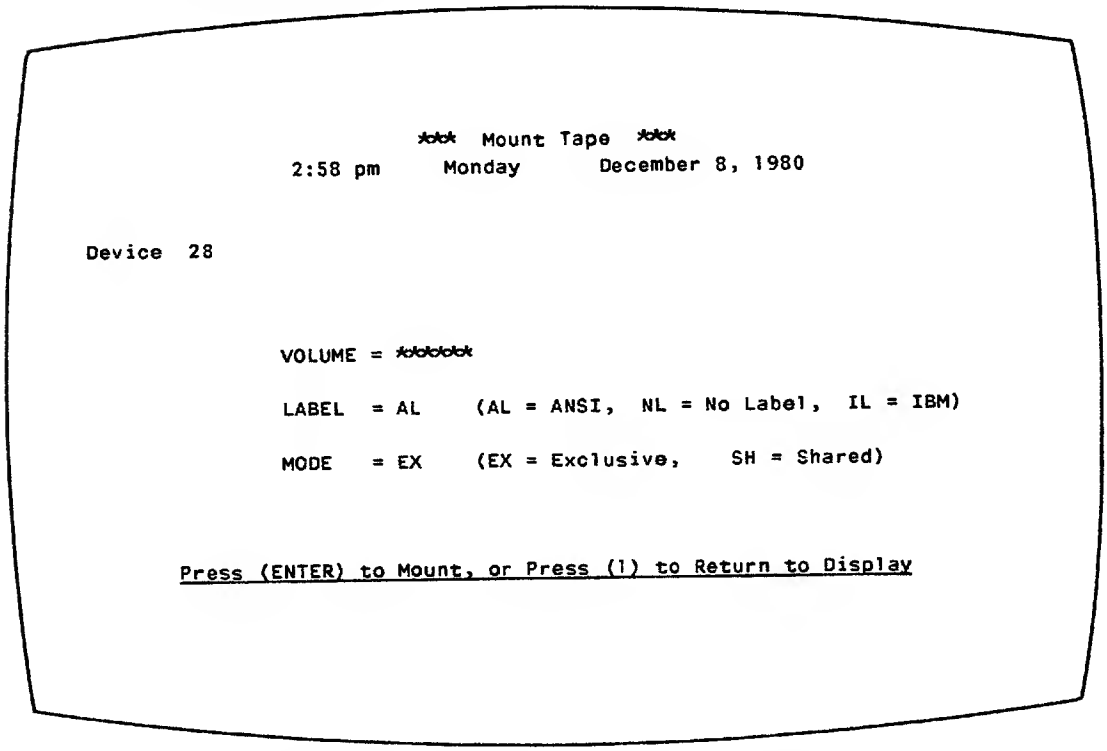


Figure 3-22. Mount Tape Screen Format

Press ENTER to initiate a logical mount; the system will prompt you to physically mount the tape. To cancel the mount and return to the TAPES screen, press PF1.

If a volume is already mounted in the specified disk unit, the system instructs you to remove that volume prior to mounting the new one unless one of the following conditions exists:

1. The volume's MODE is EX; a volume mounted with this MODE may only be dismounted from the workstation at which it was mounted.

2. The volume is "in use." A volume is in use if one or more of its files are currently open. A volume cannot be dismounted until all its files are closed.

Dismount

To logically dismount a volume, move the cursor to the line that describes the volume and press PF7. The volume name will blink. Then, press ENTER to initiate a dismount; the system will prompt you to physically dismount the tape. To cancel the dismount and return the screen to its normal state, press PF1.

You can dismount a volume only if you have the access rights to do so. Also, you cannot dismount a volume if one or more of its files are in use.

Owner Information

To receive information about the volume owners, press PF11. The Owner Information screen presents the following information in the screen's right-hand columns, as illustrated in Figure 3-23.

- Restrictions -- Exclusive or Shared
- Owner's User ID -- if applicable
- Owner's job name -- if applicable

The Owner Information screen also makes two additional commands available. These commands, Change Restrictions and Status Information, are described below.

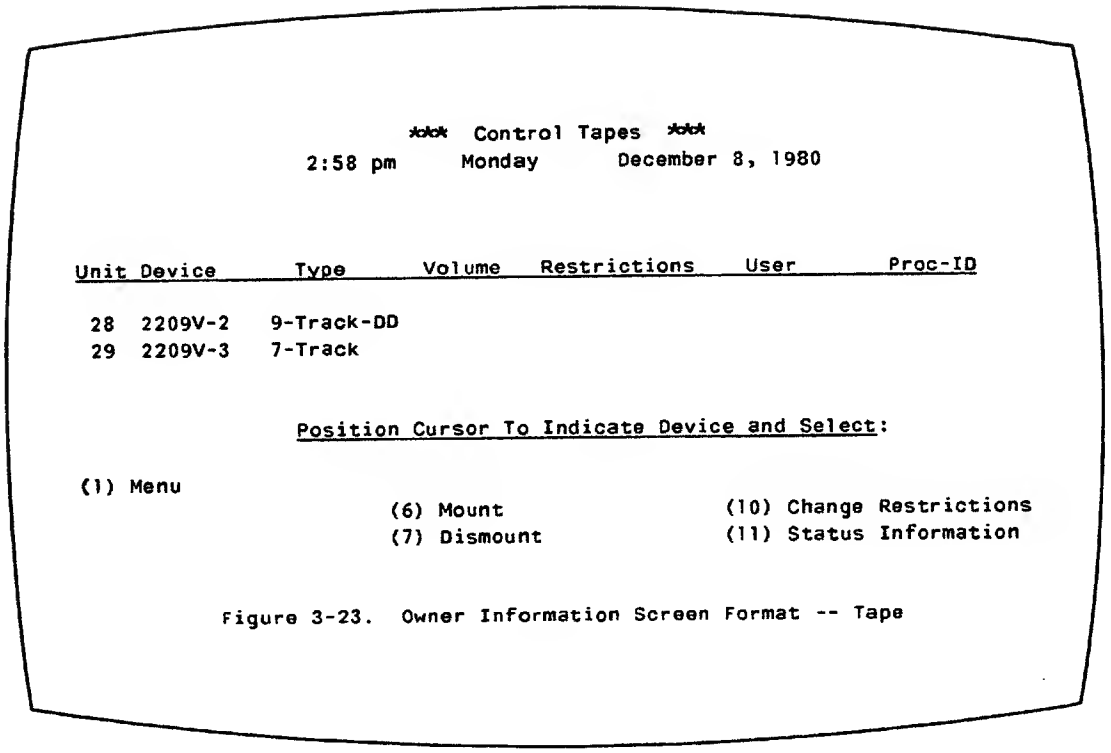


Figure 3-23. Owner Information Screen Format -- Tape

Figure 3-23. Owner Information Screen Format -- Tape

Change Restrictions

This command modifies the mount restrictions. To change these restrictions for a specific volume, move the cursor to the left of the entry for that volume, and press PF16. The system highlights the Restrictions column and lets you type over the entry. Type one of the following restrictions:

- Shared
- Exclusive

The command accepts any unique, leading substring, and the default is Shared.

Press ENTER to effect the change, or press PF1 to cancel the command and return the screen to its original state.

Status Information

Owner data replaces the label, density, and status information presented on the TAPES screen. To return to the TAPES screen, and that information, press PF11 from the Owner Information screen.

3.9.4 Managing Telecommunications Devices

To reach the TELECOMMUNICATIONS screen, press PF5 from the MANAGE DEVICES menu. The TELECOMMUNICATIONS (TC) screen provides information about all TC units configured for the system including all remote devices connected by telecommunication lines. The information is listed in the order of the unit number (device address). The following information is provided for all TC devices:

- Unit number (device address)
- Device model number
- Line name
- Polling address
- Status

If the unit currently has no device associated with it, the Type (model number) column lists it as Available. If the device is a remote workstation, the Status column contains the associated task's User ID. Figure 3-24 is a sample Telecommunications display.

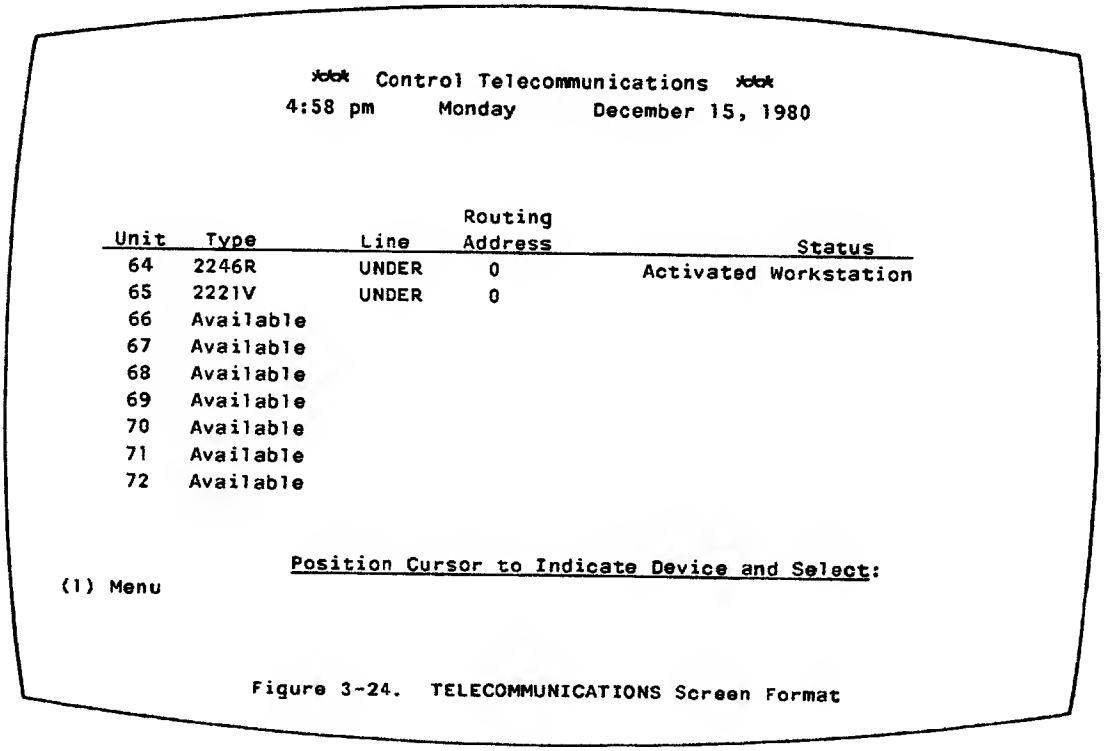


Figure 3-24. TELECOMMUNICATIONS Screen Format

Figure 3-24. TELECOMMUNICATIONS Screen Format

3.9.5 Managing Workstations

To reach the WORKSTATIONS screen, press PF6 from the MANAGE DEVICES menu. The WORKSTATIONS screen provides information about all local workstations which are configured for the system and all remote workstations which are currently connected. The unit number and device model number appear for all workstations; additional information appears in the following specific cases:

Status information	appears for any unit that is not Ready.
User ID	appears if the user is logged on.
User name	appears if the user is logged on.
Operator	appears in the Status column if the workstation is an Operator's Console.

Figure 3-25 is a sample WORKSTATIONS screen. Note that the bottom of the screen contains a list of PF keys that will move the list backward or forward if it fills more than one screen.

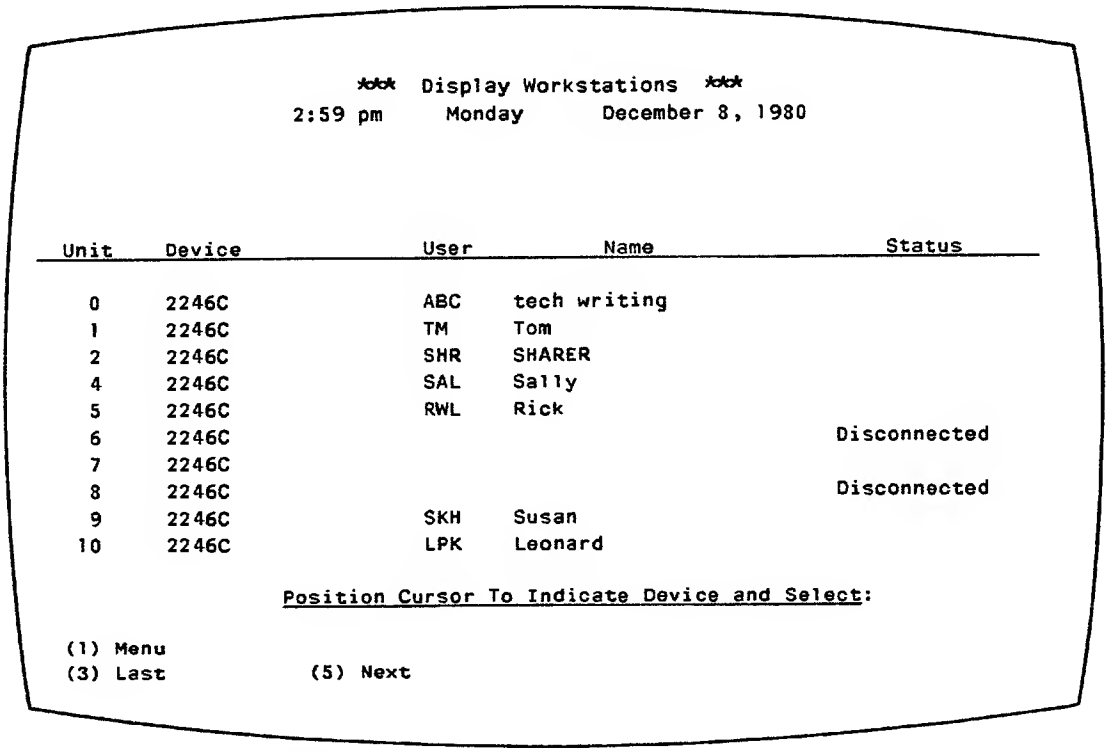


Figure 3-25. WORKSTATIONS Screen Format

3.10 ENTER WORD PROCESSING

ENTER WORD PROCESSING is associated with PF9 on the Main Command Processor menu if you have a combined workstation and the Word Processing software package. This command runs word processing on the VS directly from the Main Command Processor menu.

When you press PF9, the system displays the Word Processing menu and makes all word processing functions available. For information about VS Word Processing, consult the VS/IIS Operator's Guide and the VS/IIS Supervisor's Procedures.

3.11 ENTER DEBUG PROCESSING

ENTER DEBUG PROCESSING is associated with PF10 on the Modified Command Processing menu. When a program is interrupted, this command initiates debug processing, which allows you to inspect the program and its associated data and status information and to perform a variety of debugging operations. The facilities provided by this command are described in the VS Program Development Tools manual.

3.12 ENTER OPERATOR MODE

The ENTER OPERATOR MODE command is associated with PF11 on both Command Processor menus if you have a dual mode workstation. This command displays the Operator's Console menu, which makes all operator functions available. This menu offers the following options, which are discussed in the VS System Operation Guide:

- Display and control of print and procedure queue entries
- Control of devices
- Control of interactive and background processing tasks
- Control of device and system status
- Printing of the I/O error log

3.13 SUBMIT PROCEDURE

SUBMIT PROCEDURE is associated with PF12 on both Command Processor menus. This command submits a job for background processing on the VS. The next section discusses background jobs and their controlling procedures; Section 3.13.2 describes submitting a job.

3.13.1 Background Procedures

Background jobs are run from procedures written in the VS Procedure language (see the VS Procedure Language Reference). The procedures execute specified programs and commands, and run on a noninteractive, time-independent basis. All programs that are run by a background procedure must be fully parameterized, including all user-program GETPARMs and COBOL ACCEPT or DISPLAY statements. You parameterize a procedure by using multiple ENTER statements or default values (such as with a SET statement). You must use a SET statement within the background procedure to specify any defaults used within the background job: for example, to specify Print mode defaults.

In a background procedure, all statements that attempt any workstation I/O cause immediate abnormal termination of that background job. Note that DISPLAY statements normally force screen transactions and, therefore, should not be used in background procedures.

Three specific background processing conditions result in prompts to the operator. When any of the following conditions occur, the system displays a message at the Operator's Console; the user workstation from which the background job was submitted is not disturbed.

1. When the running procedure issues a volume mount or dismount via the MOUNT and DISMOUNT procedure statements or SVCs, the system issues a message at the Operator's Console prompting appropriate operator intervention.

2. When a volume specified in the background procedure is not mounted, the operator must either supply a unit number and mode for a subsequent mount or cancel the job.

3. When the background program or procedure encounters a possession conflict (such as a file already in use), the operator can attempt the operation again or cancel the job.

3.13.2 Submitting a Procedure

When you press PF12 (SUBMIT PROCEDURE), the system displays the screen illustrated in Figure 3-26.

```
                        ***  Submit Procedure  ***


              Identify the Procedure to be Run and Press (ENTER):

        FILE      = ********  in LIBRARY  = CJMSTUFF  on VOLUME   = NEWSYS


Scheduling Options: PROCEDURE ID       = CJM00000
                              CLASS    = A                    ("A" thru "Z")
                              STATUS   = R                    (R-Run / H-Hold)


Execution Options:        On Abnormal Termination,
                              DUMP     = P    (Y-Yes / N-No / P-Program Default)

                          CPU LIMIT    = **  :  **  :  **       Optional (HH:MM:SS)

                          If CPU Limit Exceeded,
                              ACTION   = *          (C-Cancel / W-Warn / P-Pause)


              Or Press (HELP) to Return to the Command Processor
```

Figure 3-26. SUBMIT PROCEDURE Screen Format

You specify the procedure that you want to run as a background job by entering its file, library and volume names. Next, you can specify that job's scheduling options, job name, job class, and job status, as well as the execution options for a complete dump, a CPU time limit, and the action for the system to take if the CPU time limit is exceeded. After you specify these options and press ENTER, the system validates a procedure queue entry (e.g., regarding file access) and enters it on the procedure queue. Then, the procedure either runs as soon as possible (if its Status is R) or remains on the queue until the operator or procedure owner of record releases it for execution (if its Status is H). The procedure submittal options are as follows:

FILE, LIBRARY, VOLUME — Identifies the procedure file you are submitting.

JOB NAME — An optional name which can uniquely identify the submitted job. The system prints this name on the header page of printouts created by background jobs, as well as on indicative dump pages. This name is also referred to as PROC-ID for Operator's Console functions.

CLASS — The job class (A - Z) assigned to the submitted procedure. The system processes background jobs according to the job class priority hierarchy specified from the Operator's Console (see the VS System Operation Guide); within a job class, the system processes the jobs on a first-in, first-out basis.

STATUS — Determines when the system executes the job:

R	RUN	The system executes the job as soon as possible.
H	HOLD	The system holds the job on the job queue until the operator or owner of record releases it for execution.

DUMP — Specifies whether the system will perform a complete dump upon abnormal job termination:

Y	YES	Prints a full program dump following abnormal job termination.
N	NO	Does not print a full dump following abnormal job termination.
P	DEFAULT PROGRAM	Prints a full dump following abnormal job termination only if the executing program specifies a dump and if a dump is specified for that job class (see the VS System Operation Guide).

No dump, indicative or full, is printed if the specified job procedure is nonexistent or is currently in use in I/O mode.

CPU LIMIT — An optional CPU time limit for job execution. If this limit is exceeded, the specified ACTION is performed.

ACTION — The system takes this action when the CPU LIMIT is exceeded:

C	CANCEL	Automatically cancels the procedure.
W	WARN	Sends a message to the Operator's Console informing the operator that the job has exceeded its time limit, and continues processing the job.
P	PAUSE	Suspends execution of the job and sends a message to the Operator's Console informing the operator that the job has exceeded its time limit.

For more information, refer to Section 3.7.2, "Controlling the Procedure Queue."

3.14 PRINT PROGRAM SCREEN

PRINT PROGRAM SCREEN is associated with PF14 on the Modified Command Processor menu. It prints the contents of the program screen displayed when the current program was interrupted. To print a specific program screen while the program is executing, key HELP while that screen is displayed (this accesses the Modified Command Processor menu), and then key PF14.

3.15 PRINT COMMAND SCREEN

PRINT COMMAND SCREEN is associated with PF15 on both Command Processor menus. It prints the contents of any screen displayed by the Command Processor (that is, it does not print screens displayed from the RUN command). PRINT COMMAND SCREEN is unique because you may issue it by pressing PF15 even when the Command Processor menu is not displayed.

Whenever you issue this command, it immediately attempts to print (it creates a print file containing the current screen display). If the print mode is on-line and the assigned printer is not available, PRINT COMMAND SCREEN does not execute, and the workstation audio alarm sounds.

3.16 LOGOFF

LOGOFF is associated with PF16 on the Main Command Processor menu. It logs you off the system. When you press PF16, a message appears telling you that you are terminating your current session. It also tells you to key ENTER to complete the Logoff operation, or to key HELP to return to the Command Processor. If you key ENTER and log off the system, you must repeat the Logon procedure to regain access to the system.

3.17 CANCEL PROCESSING

CANCEL PROCESSING is associated with PF16 on the Modified Command Processor menu. This command closes all open files used by the interrupted program and scratches any work files associated with it. When you press PF16, a screen appears telling you that you are terminating your current program. This screen also instructs you to key ENTER to initiate the CANCEL PROCESSING operation, key PF1 to return to debug processing, or key HELP to return to the Modified Command Processor menu. If you key ENTER when CANCEL PROCESSING completes execution, it returns you to the Main Command Processor menu, and prints a message saying that the program was cancelled by the user.

NOTE

Cancellation is not recommended while production files are being modified. CANCEL PROCESSING guarantees that the file attributes, as recorded in the Volume Table of Contents, are consistent with the file contents at the time the program is cancelled. However, CANCEL PROCESSING does not prevent problems with processing synchronization that may be caused by partially updated file contents.

APPENDIX A
WORKSTATION CHARACTER SET

NOTE: b_7 always equals zero*.	b_6 →	0	0	0	0	1	1	1	1
	b_5 →	0	0	1	1	0	0	1	1
	b_4 →	0	1	0	1	0	1	0	1

b_3	b_2	b_1	b_0	High-Order Digit → / Low-Order Digit ↓	0	1	2	3	4	5	6	7
0	0	0	0	0		â	SP	0	@	P	∘	p
0	0	0	1	1	♦	ê	!	1	A	Q	a	q
0	0	1	0	2	▶	î	"	2	B	R	b	r
0	0	1	1	3	◀	ô	#	3	C	S	c	s
0	1	0	0	4	→	û	$	4	D	T	d	t
0	1	0	1	5	⌙	ä	%	5	E	U	e	u
0	1	1	0	6	|	ë	&	6	F	V	f	v
0	1	1	1	7	··	ï	'	7	G	W	g	w
1	0	0	0	8	⁄	ö	(	8	H	X	h	x
1	0	0	1	9	⟍	ü	)	9	I	Y	i	y
1	0	1	0	A	^	à	*	:	J	Z	j	z
1	0	1	1	B	■	è	+	;	K	[	k	ß
1	1	0	0	C	‼	ù	,	<	L	⟍	l	£
1	1	0	1	D	↕	Ä	-	=	M	]	m	é
1	1	1	0	E	ß	Ö	.	>	N	↑	n	ç
1	1	1	1	F	¶	Ü	/	?	O	←	o	¢

*Bit combinations 10000000 through 11111111 are field attribute characters.

APPENDIX B
COMMON DECIMAL DATA FORMATS

There are three types of decimal representations commonly used by the VS.

B.1 EXTERNAL DECIMAL

External decimal is also referred to as free-form ASCII. External decimal characters (the numbers, 0-9, the signs, + and -, and the decimal point) are each represented in one byte. Each digit is represented by its ASCII digit. The sign, if supplied, is either the leading or trailing byte. The decimal point, represented in one byte, is positioned within the external decimal format.

External decimal items cannot be directly used in computation. The PAL (pack and align) Assembler instruction converts an external decimal to a packed decimal format which can be used in computation. COBOL performs this instruction automatically on any external decimal field used in an arithmetic operation. The external format string for any field which is to be converted to a packed format field cannot exceed 16 ASCII characters.

B.2 ZONED DECIMAL

Each digit of a zoned decimal number is represented by a single byte. The four high-order bits of each byte are zone bits; the four high-order bits of the least significant byte represent the sign of the item. The four low-order bits of each byte contain the value of the digit.

Zoned decimal items cannot be directly used in computation. The PACK Assembler instruction converts a zoned decimal to a packed decimal format which can be used in computation. COBOL performs this instruction automatically on any zoned decimal field used in an arithmetic operation. The maximum length of a zoned decimal item is 18 digits.

B.3 PACKED DECIMAL

All decimal arithmetic is performed on data in packed format.

In packed format, two decimal digits are placed adjacently in a byte except for the rightmost byte of the field. A sign is placed in the four low-order bits of this least significant byte. Both digit and sign are represented by four bits each.

The external length of a packed decimal may contain up to 31 digits and a sign.

Sample Representations of Data Formats

Decimal Format	External Value	ASCII Internal Representation	Internal Length	External Length
Zoned	123	31 32 F3	3	4
	+123	31 32 F3	3	4
	123+	31 32 F3	3	4
	123-	31 32 D3	3	4
	.123	31 32 F3	3	5
	-.123	31 32 D3	3	5
	.123-	31 32 D3	3	5
Packed	123	12 3F	2	4
	+123	12 3F	2	4
	123+	12 3F	2	4
	123-	12 3D	2	4
	.123	12 3F	2	5
	-.123	12 3D	2	5
	.123-	12 3D	2	5
External	123	31 32 33	3	3
	+123	43 31 32 33	4	4
	123+	31 32 33 43	4	4
	123-	31 32 33 45	4	4
	.123	46 31 32 33	5	5
	-.123	45 46 31 32 33	5	5
	.123-	46 31 32 33 45	5	5

APPENDIX C
VS NAMING CONVENTIONS

C.1 SYSTEM NAMING CONVENTIONS

There are several types of files and/or libraries named automatically or by default by the system. These conventions are listed below.

File or Library	Type	Algorithm	Example
Work Libraries*	System	@SYSWORK	@SYSWORK
	User (Interactive)	# + User ID + WORK	#SFKPRT
	User (Background)	# + Task Number + WORK	#015WORK
Work Files	System	@SYS + Segment Number + Task Number (The Segment number is a one-digit number of value 0, 1, or 2.)	@SYS215
	User	1st 4 char. of Prog. ID + 4-digit sequence number	EDIT0001
Print Libraries	System	#PRT	#PRT
	User	# + User ID + PRT	#SFKPRI
Print Files	System	@SYS + 4-digit sequence num.	
	@SYS0002		
	User	1st 4 char. of Prog. ID + 4-digit sequence number	EDIT0003
I/O Error Log	System (file is in @SYSWORK)	@SYSLOG	@SYSLOG
Printer/ Backgrnd. Queues	System (file is in @SYSWORK)	QUEUE	QUEUE
Temporary Files	Compilers	## + TEST	##TEST
	LINKER	## + TEMP	##TEMP

* Note that no permanent files should be placed into a work library, because work libraries are scratched when returning to the Comand Processor.

In addition to the system conventions listed above, there are two file types identified by naming conventions used both by the system and the user. These two file types are recognized by DMS and are accorded special treatment. They are the two types of temporary files, which are used by system programs (such as the language compilers and the Linker) as well as by users during program testing. These two naming conventions are as follows:

File Type	Algorithm	Example	Comments
Work	# + up to 7 char.	#TEST	File is scratched upon closing.
Temporary	## + up to 6 char.	##TEST	File is scratched upon return to the Command Processor Menu.

C.2 SUGGESTED USER NAMING CONVENTIONS

Certain user-created libraries on the VS are named by their users for the types of files they contain. Some of the VS utilities, such as the File Management Utilities, use these conventions as well. This technique of library naming permits users to group related types of files, such as data files, in one library. Additionally, this facility enables the user to assign the same file name to two related files, and place them into separate identifying libraries. For example, the source and object files for the same program may be given the same file name, but assigned to separate libraries for source and object programs. The common conventions used on the VS, such as the ones mentioned above, are listed below:

Library Type	Algorithm	Example (User SFK)
Data	ID + DATA	SFKDATA
Source Code	ID + SRCE	SFKSRCE
Object Code	ID + OBJ ID + PROG	SFKOBJ SFKPROG
Procedures	ID + PROC	SFKPROC
Test	ID + TEST ID + JUNK	SFKTEST SFKJUNK

DOCUMENT HISTORY

SUMMARY OF CHANGES
FOR THE 4TH EDITION OF THE VS PROGRAMMER'S INTRODUCTION

TOPIC	DESCRIPTION			PAGES
Command Processor	PF Key	Old	New	
	1	RUN PROGRAM OR PROCEDURE	Now additonallly includes loading of program for interactive debug.	6, 24-25
	2	SET USAGE CONSTANTS	Now includes background job submittal defaults as well as print and file defaults.	13, 25-29
	5	SHOW VOLUME CONTENTS	Renamed MANAGE FILES/ LIBRARIES. Displays contents of volumes, libraries, and files; permits renaming, scratching and protection operations; and allows printing of files.	31-37
	7	RENAME FILES	Replaced by function within PF 5, MANAGE FILES/LIBRARIES.	31-37
	7	SCRATCH FILES	Replaced by function within PF 5, MANAGE FILES/LIBRARIES.	31-37
	9	PROTECT FILES	Replaced by function within PF 5, MANAGE FILES/LIBRARIES.	31-37
	11	SELECT SPECIAL COMMANDS	Replaced by CONTROL PRINT/ JOB QUEUES (new function).	40-43
		LOAD PROGRAM OR PROCEDURE	Replaced by LOAD OPTION for PF 1, RUN PROGRAM OR PROCEDURE.	25

TOPIC	DESCRIPTION			PAGES
	PF Key	Old	New	
		SHOW SYSTEM STATUS	Available from Operator's Console Menu. Not available to nonoperators.	
		ATTACH DEVICE	Available from Operator's Console Menu. Not available to nonoperators.	
		DETACH DEVICE	Available from Operator's Console Menu. Not available to nonoperators.	
	12	Undefined	SUBMIT JOB (new function).	43-45
	14	Undefined	PRINT PROGRAM SCREEN (new function).	45
	15	PRINT SCREEN	PRINT PROGRAM SCREEN. No functional change.	45-46
Background Processing	New, noninteractive background processing facility is now available on the VS. See also the VS System Operation Guide (800-1102SO-05).			15-16, 42-43, 43-45
Debug Facility	The VS symbolic program debugging facility is now available for Assembler language.			68-69
System Utilities	Now documented in the VS Utilities Reference Manual (800-1303UT-01).			
Procedure Language	Now documented in the VS Procedure Language Reference Manual (800-1205PR-01).			
General	Miscellaneous editorial changes.			

This manual is updated by:
Addendum 800-1101PI-05.01

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Printed in U.S.A.
800-1101PI-05
8-82-20M